DEVELOPING A STATE WATER PLAN

GROUND-WATER CONDITIONS IN UTAH, SPRING OF 1974

by

Jerry C. Stephens and others

U.S. Geological Survey

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INTRODUCTION

This report is the eleventh in a series of annual reports that describe ground-water conditions in Utah. Reports in the series, prepared cooperatively by the U.S. Geological Survey and the Utah Division of Water Resources, are designed to provide data for interested parties such as legislators, administrators, and planners to keep abreast of changing ground-water conditions.

This report, like the others (see references, p. 18), contains information on well construction, ground-water withdrawals, water-level changes, and related changes in precipitation and streamflow. Supplementary data such as graphs showing chemical quality of water and maps showing water-table configuration are included in reports of this series only for those years or areas for which applicable data are available and are important to a discussion of changing ground-water conditions.

The report includes individual discussions of the most important areas of ground-water withdrawal in the State for the calendar year 1973. Water-level fluctuations, however, are described for the period spring 1973 to spring 1974. Many of the data used in the report were collected by the Geological Survey in cooperation with the Division of Water Rights, Utah Department of Natural Resources.

The following reports dealing with ground water in the State were released by the Geological Survey during 1973:

Geologic appraisals of Paradox Basin salt deposits for waste emplacement, by R. J. Hite and S. W. Lohman, U.S. Geological Survey open-file report.

Ground-water conditions in Utah, spring of 1973, by E. L. Bolke and others, Utah Division of Water Resources Cooperative Investigations Report 12.

Ground water in the Milford area, Utah, by R. W. Mower and R. M. Cordova, Utah Geological Association Publication 3, p. 63-71.

Ground-water resources of the lower Bear River drainage basin, Box Elder County, Utah, by L. J. Bjorklund and L. J. McGreevy, Utah Department of Natural Resources Technical Publication 44 (in press).

Hydrologic reconnaissance of the northern Great Salt Lake Desert and summary hydrologic reconnaissance of northwestern Utah, by J. C. Stephens, Utah Department of Natural Resources Technical Publication 42.

Map showing concentration of dissolved solids in water from the principal aquifer, Sugar House quadrangle, Salt Lake County, Utah, by R. W. Mower, U.S. Geological Survey Miscellaneous Geologic Investigations Map I-766-K.

Map showing configuration of the potentiometric surface of t .e principal aquifer and its approximate position relative to land surface, Sugar House quadrangle, Salt Lake County, Utah, February 1972, by R. W. Mower, U.S. Geological Survey Miscellaneous Geologic Investigations Map I-766-L.

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Map showing minimum depth to water in shallow aquifers (1963-72) in the Sugar House quadrangle, Salt Lake County, Utah, by R. W. Mower and Richard Van Horn, U.S. Geological Survey Miscellaneous Geologic Investigations Map I-766-I.

Map showing thickness of saturated Quaternary deposits, Sugar House quadrangle, Salt Lake County, Utah, February 1972, by R. W. Mower, U.S. Geological Survey Miscellaneous Geologic Investigations Map I-766-H.

Quality of ground water in the Lower Colorado River Region, Arizona, Nevada, New Mexico, and Utah, by L. R. Kister, U.S. Geological Survey Hydrologic Investigations Atlas HA-478.

Selected hydrologic data in the Upper Colorado River Basin, by Don Price and K. M. Waddell, U.S. Geological Survey Hydrologic Investigations Atlas HA-477.

Summary appraisals of the nation's ground-water resources--Upper Colorado Region, by Don Price and Ted Arnow, U.S. Geological Survey Professional Paper 813-C (in press).

Water resources of the Curlew Valley drainage basin, Utah and Idaho, by C. H. Baker, Jr., Utah Department of Natural Resources Technical Publication 45 (in press).

Water resources of the Milford area, Utah, with emphasis on ground water, by R. W. Mower and R. M. Cordova, Utah Department of Natural Resources Technical Publication 43 (in press).

Metric (SI) units

Most numbers are given in this report in English units followed by metric units in parentheses. The conversion factors used are:

English			Metric	
Units (Multiply)	Abbreviation	(by)	Units (To obtain)	Abbreviation
Acre-feet	acre-ft	0.0012335	Cubic hectometers	hm^3
Feet	ft	.3048	Meters	m
Inches	in.	25.4	Millimeters	mm
Miles	mi	1.609	Kilometers	km
Square miles	mi^2	2.59	Square kilometers	km^2

Chemical concentration is given only in metric units--milligrams per liter (mg/l). For concentrations less than 7,000 mg/l, the numerical value is about the same as for concentrations in the English unit, parts per million.

UTAH'S GROUND-WATER RESERVOIRS

Small quantities of ground water can be obtained from wells throughout much of Utah, but large supplies that are of suitable chemical quality for irrigation, public supply, or industrial use, generally can be obtained only in specific areas. The major areas of ground-water development that are discussed in this report are shown in figure 1 and named in table 1. Only a few wells outside of these areas yield large supplies of water of good chemical quality.

Less than 2 percent of the wells in Utah obtain water from consolidated rocks. The consolidated rocks that yield the most water are lava flows such as basalt, which contains interconnected vesicular openings or fractures; limestone, which contains fractures or other openings enlarged by solution; and sandstone, which contains interconnected openings between the grains that form the rock and may also contain open fractures. Most of the wells that tap consolidated rocks are in the eastern and southern parts of the State, in areas where water supplies cannot be obtained readily from unconsolidated rocks.

More than 98 percent of the wells in Utah draw water from unconsolidated rocks. These rocks may consist of boulders, gravel, sand, silt, or clay, or a mixture of some or all of these sizes. Wells obtain the largest yields from the coarser materials that are sorted into deposits of uniform grain size. Most wells that tap unconsolidated rocks are in large intermountain basins, which have been partly filled with debris from the adjacent mountains.

Table 1.--Areas of ground-water development in Utah discussed in this report

(Locations are shown in fig. 1)

Area	Principal type of water-bearing rocks
1. Grouse Creek valley	Unconsolidated
2. Park Valley	Do.
3. Curlew Valley	Unconsolidated and consolidated
4. Malad-lower Bear River valley	Unconsolidated
5. Cache Valley	Do.
6. Bear Lake valley	Do.
7. Upper Bear River valley	Do.
8. Ogden Valley	Do.
9. East Shore area	Do.
10. Jordan Valley	Do.
11. Tooele Valley	Do.
12. Dugway area	Do.
13. Cedar Valley	Do.
14. Utah and Goshen Valleys	Do.
15. Heber Valley	Do.
16. Duchesne River area	Unconsolidated and consolidated
17. Vernal area	Do.
18. Sanpete Valley	Unconsolidated
19. Juab Valley	Do.
20. Central Sevier Valley	Do.
21. Pavant Valley	Do.
22. Sevier Desert	Do.
23. Snake Valley	Do.
24. Milford area	Do.
25. Beaver Valley	Do.
26. Upper Sevier Valleys	Do.
27. Upper Fremont Valley	Unconsolidated and consolidated
28. Monticello area	Unconsolidated
29. Blanding area	Do.
30. Parowan Valley	Unconsolidated and consolidated
31. Cedar City Valley	Unconsolidated
32. Beryl-Enterprise area	Do.
33. Central Virgin River area	Unconsolidated and consolidated

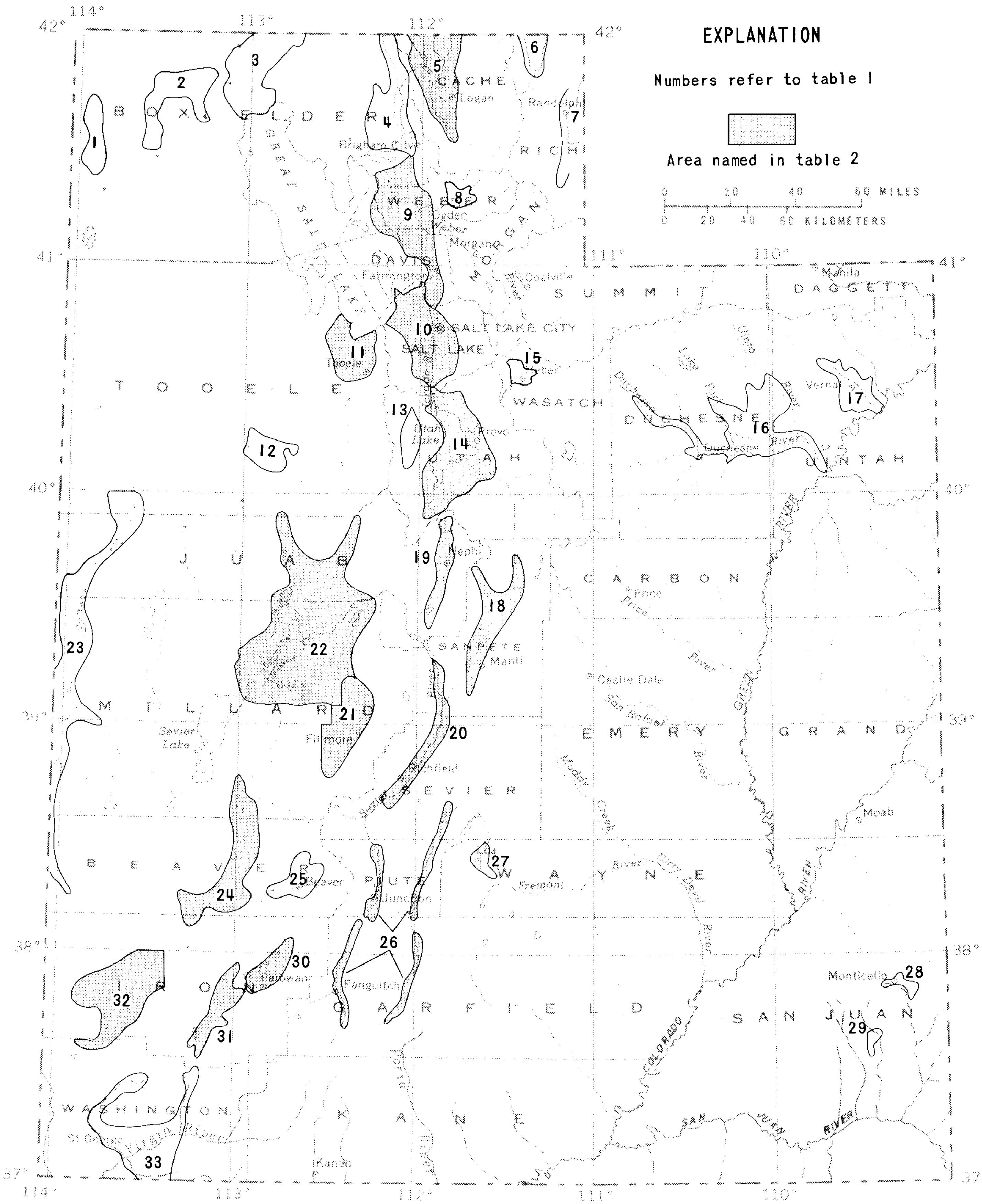


Figure 1.— Areas of ground-water development discussed in this report.

SUMMARY OF CONDITIONS

The estimated total withdrawal of water from wells in Utah in 1973 was about 714,000 acre-feet (881 hm^3), about 83,000 acre-feet (102 hm^3) less than in 1972, but more than 40,000 acre-feet (49.3 hm^3) greater than the average annual withdrawal for the period 1963-72 (table 2). Both the decrease from 1972 and the increase over the 10-year average were due primarily to changes in withdrawals for irrigation.

Estimated total withdrawals for irrigation in 1973 were about 480,000 acre-feet (592 hm^3), about 16 percent less than the 569,000 acre-feet (702 hm^3) withdrawn in 1972 (Bolke and others, 1973, p. 7). Irrigation withdrawals in nearly all the major ground-water areas in Utah were less in 1973 than in 1972. In only two of the areas listed in table 2, Cache Valley and the East Shore area (both in northern Utah), was there an increase in ground-water withdrawals for irrigation in 1973.

The quantity of water withdrawn from wells for irrigation relates closely to local climatic conditions. Precipitation in 1973 was above average throughout most of Utah. Much of the precipitation accumulated early in the year in the form of abnormally heavy snowpacks in the mountainous areas, especially in the southern two-thirds of the State. Some areas of southern Utah were reported to have snow accumulations of almost five times the long-term average--the Bear River basin in northern Utah was the only area in the State with less than average snowpack in March (U.S. Department of Agriculture, 1973).

Runoff from the large snowpack was above average in both volume and duration in much of the State. The increased availability of surface water in the spring and early summer had a significant, threefold effect on ground-water conditions: ground-water recharge from streams was increased; early spring pumping for irrigation was curtailed, resulting in a shorter pumping season; and more surface water was used for irrigation, resulting in decreased demand for ground water during the growing season. In addition, precipitation during the growing season continued to be above average in many of the irrigated valleys, further reducing withdrawals of ground water for supplemental irrigation.

Changes in ground-water levels in southern and central Utah from the spring of 1973 to the spring of 1974 reflected the generally increased availability of surface water and the reduction in ground-water withdrawals. Water levels rose generally in most major ground-water basins in the southern two-thirds of the State. In northern Utah, water-level changes were variable, with no consistent trend evident. Cache Valley, in the Bear River basin, was the only major ground-water basin in the State in which water levels were generally lower in March 1974 than in March 1973.

The larger ground-water basins and those containing most of the ground-water developments in Utah are shown in figure 1 and are listed in table 2. Also listed in table 2 is information about the number of wells constructed and the withdrawal of water from wells in 1973 and, for comparison, total withdrawals in 1972 and average annual withdrawals during the 10-year period 1963-72. The discussions that follow summarize ground-water development and changes in ground-water conditions in the areas of major ground-water development.

Table 2.--Well construction and withdrawal of water from wells in major areas of ground-water development in Utah

Area	Number in figure 1	Number of wells completed in 1973[1]			Withdrawal from wells (acre-feet)						
		Diameter		New large-withdrawal wells[3]	1973					1972 Total[4]	1963-72 Average annual[5]
		Less than 6 inches[2]	6 inches or more[2]		Irrigation	Industry	Public supply	Domestic and stock	Total (rounded)		
Cache Valley	5	10	7	1	12,200	7,000[6]	2,850	2,100	24,200	23,300	26,100
East Shore area	9	14	9	4	17,500[7]	6,800	18,200		42,500	41,400	46,300
Jordan Valley	10	6	23	8	4,100	43,100[8]	48,100	33,500[6]	128,800	124,500	111,700
Tooele Valley	11	1	19	3	25,000[7]	800	3,500	100	29,400	29,200	23,500
Utah and Goshen Valleys	14	34	56	7	53,900	7,900	14,500	12,700	89,000	91,200	82,400
Juab Valley	19	0	8	6	16,600	50	5	150	16,800	29,600	20,800
Sevier Desert	22	8	4	2	18,500	700	1,400	1,300	21,900	39,900	27,000
Sanpete Valley	18	1	8	2	12,000	400	500	3,000[9]	15,900	20,500	15,500
Upper and central Sevier Valleys	26,20	26	22	2	11,600	100	1,500	6,100	19,300	19,300	19,100
Pavant Valley	21	0	7	0	68,600	100	200	300	69,200	98,600	77,300
Cedar City Valley	31	0	14	8	24,900[1]	500	1,250[1]	150	26,800	34,900	27,000
Parowan Valley	30	0	3	3	24,400[1,10]	0	1,000[1]	150	25,600	28,000	20,300
Escalante Valley Milford area	24	0	8	8	50,500[11]	300	700	100	51,600	59,300	50,600
Beryl-Enterprise area	32	0	26	5	73,400[1]	0	25	600	74,000	77,100	73,600
Other areas		15	175	56	66,700[12]	2,500[12]	9,100[12]	1,000[12]	79,300[12]	80,000[12]	50,600[12]
Totals (rounded)		115	389	115	480,000	70,000	103,000	61,000	714,000	797,000	672,000

[1]Data from Utah Department of Natural Resources, Division of Water Rights.
[2]Includes replacement wells.
[3]New wells (6 inches or more in diameter) constructed for irrigation, industrial, or public supply.
[4]From Bolke and others, 1973, p. 7.
[5]Calculated from Bolke and others, 1973, p. 8.
[6]Includes some use for fish and fur culture.
[7]Includes some domestic and stock use.
[8]Includes some use for air conditioning.
[9]Includes some use for irrigation.
[10]Includes some use for stock.
[11]Data for withdrawals for irrigation obtained from Milford Water Commissioner.
[12]Estimated minimum amount.

MAJOR AREAS OF GROUND-WATER DEVELOPMENT

CACHE VALLEY

by L. J. Bjorklund

During 1973 about 24,200 acre-feet (29.9 hm^3) of water was discharged from pumped and flowing wells in Cache Valley, Utah, as compared to 23,300 acre-feet (28.7 hm^3) in 1972 (Bolke and others, 1973, p. 9) and 23,500 acre-feet (29.0 hm^3) in 1971 (Sumsion and others, 1972, p. 8). The slightly greater withdrawal of water from irrigation wells during 1973 was probably due to less surface water available for irrigation. Pumping from wells for irrigation, however, ceased for the season in September, during which almost 5 inches (127 mm) of precipitation fell in the valley.

Ground-water levels declined slightly--generally less than 2 feet (0.6 m)--in most of the valley in the March 1973-March 1974 period (fig. 2). This decline was probably related to the slight increase of ground-water withdrawal during 1973.

The long-term trend of the water level in well (A-12-1)29cab-1, the annual discharge of the Logan River near Logan, and the cumulative departure from average precipitation at Logan are shown in figure 3 for comparison. The general rise of water level in the well since 1967 shows the effects of the greater-than-average precipitation during the same period. The decline of water level in the well during the March 1973-March 1974 period is probably related to the slight increase in well discharge for irrigation and to a decrease in flow in the Logan River during 1973. The flow of the Logan River during 1973 was about 10 percent below the 1941-73 average, following two consecutive years of abnormally high flow.

EAST SHORE AREA

by E. L. Bolke

The withdrawal from wells in the East Shore area in 1973 was about 42,500 acre-feet (52.4 hm^3), 1,100 acre-feet (1.4 hm^3) more than that reported for 1972 (Bolke and others, 1973, p. 10). The increase was due chiefly to withdrawal from small-diameter multiple-use wells. The withdrawal from these small wells is included under "irrigation" in table 2.

From March 1973 to March 1974 water levels rose in about 70 percent of the East Shore area (fig. 4). Most of the rises were less than 2 feet (0.6 m) and were probably due to above-average precipitation during 1973 (fig. 6). The largest rises, more than 4 feet (1.2 m), were in the Bountiful area, in an area east of Layton, and in a small area south of Willard. The largest declines, more than 4 feet (1.2 m) were northwest of Ogden and may have been due to local pumping effects.

Whereas figure 4 shows the year-to-year change in the potentiometric surface in the East Shore area, figure 5 shows the altitude of the potentiometric surface and the general direction of ground-water movement in the East Shore area for March 1974. The general direction of ground-water movement is westward from the mountains toward Great Salt Lake.

The long-term relation between water levels in selected wells and precipitation at Ogden Pioneer powerhouse is shown in figure 6.

JORDAN VALLEY

by R. W. Mower

The withdrawal of water from wells in Jordan Valley in 1973 was 128,800 acre-feet (158.9 hm^3), an increase of 4,300 acre-feet (5.3 hm^3)--about 3 percent--over that in 1972 (Bolke and others, 1973, p. 11) and 17,100 acre-feet (21.1 hm^3)--about 15 percent--more than the average reported for the previous 10 years, 1963-72 (Bolke and others, 1973, p. 8). Withdrawals in 1973 increased slightly for public supply and industry because of an increase in population (fig. 7) and an increase in industrial activity, decreased slightly for irrigation because of an increase in precipitation resulting in an increase of surface-water supplies, and remained about the same for domestic and stock supplies.

Water levels rose from February 1973 to February 1974 in about 60 percent of Jordan Valley (fig. 8) and declined in about 40 percent; the average change in water level in the valley was a rise of 0.7 foot (0.2 m). The maximum observed rise was more than 10 feet (3.0 m) in a small area in the north part of Salt Lake City. The maximum observed decline was more than 10 feet (3.0 m) in a small area near the south part of Salt Lake City. The maximum rises occurred in areas where the volume of recharge was greater than normal and where pumping was less during 1973 than it was during 1972. The declines were due, generally, to increased pumping for public supply and industry.

The relation between fluctuations of precipitation and water levels in selected wells is illustrated in figure 9. Precipitation at Silver Lake Brighton during 1973 was about 7.4 inches (188 mm) above the average for 1931-73. The above-average precipitation and only moderately increased pumping locally are reflected by a moderate rise of water levels in two wells, no change in one well, and a small decline in one well.

TOOELE VALLEY

by L. R. Herbert

The withdrawal of 29,400 acre-feet (36.3 hm^3) of water from wells in Tooele Valley in 1973 was 200 acre-feet (0.2 hm^3) more han was reported for 1972 (Bolke and others, 1973, p. 12). The increase was due to increased municipal water use.

The discharge from springs in 1973 was approximately 17,100 acre-feet (21.1 hm^3), an increase of 2,400 acre-feet (3.0 hm^3) over the previous year. About 2,300 acre-feet (2.8 hm^3) of springflow was used for irrigation and stock in the valley, and about 14,800 acre-feet (18.3 hm^3) was diverted to Jordan Valley for industrial use.

Water levels rose in most of Tooele Valley from March 1973 to March 1974 (fig. 10) due to above-average precipitation during 1973. The greatest rises occurred in the Erda district, where irrigation wells were pumped less in 1973 than in 1972. Water-level declines of less than 2 feet (0.6 m) occurred in parts of the Grantsville, Marshall, and Burmester districts, due mainly to the residual effects of increased pumping near Grantsville.

A map of the potentiometric surface of the principal artesian aquifer in Tooele Valley in March 1974 (fig. 11) indicates that the general direction of ground-water movement is northward toward Great Salt Lake. The position and configuration of the water-level contours are essentially the same as they were in 1962 (see Arnow and others, 1964, p. 34).

The long-term relation between water levels in selected wells and precipitation at Tooele is shown in figure 12. Precipitation at Tooele in 1973 totaled 18.89 inches (480 mm), 1.00 inch (25 mm) more than reported in 1972, and 2.39 inches (61 mm) more than the 1936-73 average. Because of the above-average precipitation, water levels rose in most of the wells in Tooele Valley.

UTAH AND GOSHEN VALLEYS

by R. M. Cordova

Withdrawal of water from wells in Utah and Goshen Valleys in 1973 was 89,000 acre-feet (109.8 hm^3), which is 2,200 acre-feet (2.7 hm^3) less than reported for 1972 (Bolke and others, 1973, p. 13). Withdrawals in 1973 compared to 1972 for irrigation and public supply were less by 2,900 and 900 acre-feet (3.6 and 1.1 hm^3), respectively, but withdrawal for industry was greater by 1,600 acre-feet (2.0 hm^3). In Utah Valley 74,100 acre-feet (91.4 hm^3) of water was withdrawn in 1973, or 1,500 acre-feet (1.9 hm^3) more than in 1972; in Goshen Valley 14,900 acre-feet (18.4 hm^3) was withdrawn in 1973, or 3,700 acre-feet (4.6 hm^3) less than in 1972.

Water levels in most observation wells rose from March 1973 to March 1974 (figs. 13-16). The general rise resulted from decreased ground-water withdrawal and significantly above-normal precipitation (fig. 17).

JUAB VALLEY

by R. G. Butler

The discharge from pumped and flowing wells in Juab Valley during 1973 was about 16,800 acre-feet (20.7 hm^3), a decrease of 12,800 acre-feet (15.8 hm^3) from that reported for 1972 (Bolke and others, 1973, p. 14). This decrease was due chiefly to reduced pumping for irrigation.

From March 1973 to March 1974 water levels rose throughout the valley (fig. 18). Maximum rises of more than 18 feet (5.5 m) were observed near Levan and more than 11 feet (3.4 m) at Nephi and in an area about 4 miles (6.4 km) north of Mona. The rise in water levels resulted from a reduction in the amount of water pumped for irrigation and an increase in the amount of water available from streams entering the valley.

The relation of water levels in selected wells and the cumulative departure from average precipitation at Nephi is shown in figure 19. Much of the above-average precipitation in 1973 accrued during the period January to April, making it possible to curtail early season pumping for irrigation.

SEVIER DESERT

by R. W. Mower

The withdrawal of water from wells in the Sevier Desert in 1973 was about 21,900 acre-feet (27.0 hm^3). This amount was 18,000 acre-feet (22.2 hm^3)--about 45 percent--less than was reported for 1972 (Bolke and others, 1973, p. 15) and 5,100 acre-feet (6.3 hm^3) less than the average annual withdrawal reported for the previous 10 years, 1963-72 (Bolke and others, 1973, p. 8). The decrease was due chiefly to a decrease in pumpage for irrigation (about 50 percent less than in 1972) because surface water was more plentiful. During 1973, discharge of the Sevier River near Juab, the nearest station above all diversions in the Sevier Desert, was about 186,000 acre-feet (229.4 hm^3), 41,000 acre-feet (50.6 hm^3) or about 28 percent more than during 1972.

Water levels in both the lower and upper artesian aquifers rose from March 1973 to March 1974 in most parts of the Sevier Desert (figs. 20 and 21). The maximum water-level rise in both artesian aquifers was slightly more than 8 feet (2.4 m) near Oak City. Declines of less than 1 foot (0.3 m) were observed in much of the western part of the upper artesian aquifer and in the southern part of the lower artesian aquifer.

The long-term relation between precipitation at Oak City and water levels in selected wells is shown in figure 22. Precipitation was slightly above average at Oak City during 1973. Water levels rose in all three observation wells from March 1973 to March 1974, indicating that the withdrawal from wells in 1973 was less than the recharge in some heavily pumped parts of the Sevier Desert.

SANPETE VALLEY

by R. G. Butler

The withdrawal of water from wells in Sanpete Valley during 1973 was about 15,900 acre-feet (19.6 hm^3) or 4,600 acre-feet (5.7 hm^3) less than that reported for 1972 (Bolke and others, 1973, p. 16). This decrease was due to decreased pumping for irrigation.

From March 1973 to March 1974 water levels rose in the entire valley (fig. 23). Rises of more than 8 feet (2.4 m) were observed in several areas, with the maximum rise of slightly more than 14 feet (4.3 m) observed near Ephraim.

Hydrographs of water levels in three wells in Sanpete Valley and the long-term trend of precipitation at Manti are shown in figure 24. Water levels rose in all three wells from March 1973 to March 1974 although precipitation was slightly below average. This rise in water levels is due, for the most part, to the decrease of pumping for irrigation.

THE UPPER AND CENTRAL SEVIER VALLEYS

by G. W. Sandberg

The withdrawal of water from wells in the upper and central Sevier Valleys was about 19,300 acre-feet (23.8 hm^3) in 1973, the same as for the previous year (Bolke and others, 1973, p. 17). Water levels rose in 19 observation wells, declined in 6 wells, and remained unchanged in 1 well from March 1973 to March 1974 (fig. 25). The largest observed rise, 6.5 feet (2.0 m), was north of Rubys Inn and the greatest observed decline, 2.0 feet (0.6 m), was southwest of Spry. Both wells are in the upper Sevier Valley.

The relation between water levels in selected wells, annual discharge of the Sevier River at Hatch, and precipitation at Salina and Panguitch are shown in figure 26. Precipitation was 4.3 inches (97 mm) above average at Salina and 1.32 inches (34 mm) below average at Panguitch, and runoff was much greater than usual along the entire Sevier River drainage. The generally increased precipitation and runoff are reflected in the rise of water levels in the observation wells. The water level in well (C-34-5)8adb-2 was at the highest level observed since 1942. Flow in the Sevier River at Hatch for 1973 was the third highest in 34 years of record.

PAVANT VALLEY

by C. T. Sumsion

Withdrawal of water from wells in Pavant Valley in 1973 was about 69,200 acre-feet (85.4 hm^3), which was 29,400 acre-feet (36.3 hm^3) less than reported for 1972 (Bolke and others, 1973, p. 18). The decrease was due to less pumpage for irrigation. Precipitation was above average, and more surface water was available for irrigation during 1973.

From March 1973 to March 1974 water levels rose throughout most of the valley (fig. 27). The largest rises occurred in the area from Fillmore and Flowell southward to Kanosh, with maximum rises of more than 20 feet (6.1 m) at Meadow and east of Hatton. Rises in this area were due to smaller drawdowns because of decreased pumpage and to increased recharge in 1973. Water levels continued to decline slightly in parts of the McCornick and Greenwood districts and in two small areas of the Kanosh district, as recharge in parts of these districts was less than pumpage in 1973.

The relation between water levels in selected observation wells and cumulative departure from the 1931-73 average precipitation at Fillmore is shown in figure 28. Water levels rose in nearly all observation wells in response to decreased pumping and increased precipitation. However, the water level in the observation well in the Greenwood district continued to decline slightly.

Some of the water pumped for irrigation in Pavant Valley returns to the ground-water system as recharge and is then withdrawn again for irrigation. Such recirculation of ground water affects its chemical quality (Handy and others, 1969, p. D228-D234). The concentration of dissolved solids measured in 1973 in water from three wells was greater than in earlier years, a trend that has been evident since at least 1957 in parts of the area, as shown in figure 29.

CEDAR CITY VALLEY

by L. J. Bjorklund

Water pumped from wells in Cedar City Valley during 1973 amounted to approximately 26,800 acre-feet (33.1 hm^3) as compared to 34,900 acre-feet (43.0 hm^3) in 1972 (Bolke and others, 1973, p. 19) and 35,700 acre-feet (44.0 hm^3) in 1971 (Sumsion and others, 1972, p. 16). The substantial decrease in pumpage during 1973 was due mainly to the increase in available surface water for irrigation in streams that enter the valley, principally Coal Creek.

Water levels in wells rose significantly in virtually all the valley (fig. 30). Rises were greatest along the southeast margin where Coal Creek and other streams enter the valley and least along the west margin. Rises of more than 4 feet (1.2 m) occurred in more than 50 square miles (130 km^2) in the valley. The rises were due mostly to recharge from water in Coal Creek and other streams and surface-water irrigation. In part, the rises were due to less pumpage from wells, which was also a consequence of both the extra surface water available for irrigation and the above-average precipitation during the growing season.

The water level in an observation well 3 miles (4.8 km) northwest of Cedar City, cumulative departure from average precipitation, annual discharge in Coal Creek, and annual pumpage from wells in Cedar City Valley are shown in figure 31. The water-level, stream-discharge, and pumpage graphs all reflect the effects of above-average precipitation during 1973. The stream-discharge graph shows that the discharge of Coal Creek was by far the greatest since records were first collected in 1936.

PAROWAN VALLEY

by L. J. Bjorklund

During 1973 about 25,600 acre-feet (31.6 hm^3) of water was discharged from pumped and flowing wells in Parowan Valley as compared to 28,000 acre-feet (34.5 hm^3) in 1972 (Bolke and others, 1973, p. 20) and 24,100 acre-feet (29.7 hm^3) in 1971 (Sumsion and others, 1972, p. 16). The decrease from the preceding year in withdrawals was a result of above-average precipitation during the growing season and a slightly shortened pumping season.

Water levels in wells rose substantially in almost the entire valley during the March 1973-March 1974 period (fig. 32). Rises of more than 12 feet (3.7 m) were observed in an area of about 16 square miles (41.4 km^2). The rises in water level were greatest along the southeastern margin of the valley where Parowan Creek enters and least in the western half of the valley. In small areas north of Paragonah and near the northeastern end of the valley, water levels declined by less than 2 feet (0.6 m), probably as a result of locally heavy pumping.

The water-level rises were due mostly to recharge resulting from excessive precipitation and runoff during the year. Some flooding occurred in Parowan Creek, and high flows continued into the middle of summer. The flow in Parowan Creek and other streams entering the valley was probably the greatest in many years--the 1973 discharge in a nearby stream, Coal Creek near Cedar City, was the greatest observed since the beginning of record in 1936 (fig. 31). The rises in water levels in wells were also due, in part, to a slightly shortened pumping season in the valley.

The long-term relations of water levels in an observation well near Paragonah, precipitation, and total withdrawals from wells in the valley are shown in figure 33. The graphs show that precipitation has been greater than average in most years since 1960, but the water level in well (C-34-8)5bca-1 has neither risen nor declined substantially during the same period. This is probably related to the fact that withdrawals from wells increased during the period, as is illustrated in the bar graph.

ESCALANTE VALLEY

Milford area

by R. W. Mower

The withdrawal of water from wells in the Milford area in 1973 was about 51,600 acre-feet (63.6 hm^3). This amount was 7,700 acre-feet (9.5 hm^3)--about 13 percent--less than was reported for 1972 (Bolke and others, 1973, p. 21) and only 1,000 acre-feet (1.2 hm^3) more than the average annual withdrawal reported for the previous 10 years, 1963-72 (Bolke and others, 1973, p. 8). The decrease was due chiefly to a decrease in pumpage for irrigation (about 12 percent less than in 1972) because surface water was more plentiful. During 1973, discharge of the Beaver River at Rockyford Dam near Minersville was about 45,000 acre-feet (55.5 hm^3), about 26,000 acre-feet (32.1 hm^3) or about 140 percent more than during 1972.

Water levels rose from March 1973 to March 1974 in 88 percent of the Milford area (fig. 34); the average change in water level in the area was a rise of 0.9 foot (0.3 m). The maximum observed rise was more than 8 feet (2.4 m) in a small area about 2 to 5 miles (3-8 km) south of Milford. The maximum observed declines were less than 2 feet (0.6 m) in areas west of Milford, at Minersville, and 5 to 15 miles (8-24 km) west of Minersville. The maximum rises were in areas where the volume of recharge was greater than normal and where pumping was less than in 1972. The declines were due to continued pumping for irrigation or industry in the areas west of Milford and west of Minersville, and to greatly reduced recharge from canal losses at Minersville due to replacement of a canal with a pipeline.

The relations between water levels in well (C-29-10)6ddc-2 near the middle of the pumped area, precipitation at Milford airport, discharge of the Beaver River, and ground-water withdrawals are shown in figure 35. Precipitation at Milford in 1973 was 2.05 inches (52 mm) above the 1932-73 average. The rise of water levels caused by the decreased withdrawals and the increased availability of surface water is represented by the water-level rise in well (C-29-10)6ddc-2.

Beryl-Enterprise area

by G. W. Sandberg

The withdrawal of water from wells in the Beryl-Enterprise area in 1973 was about 74,000 acre-feet (91.3 hm^3), a decrease of 3,100 acre-feet (3.8 hm^3) compared to the amount reported in 1972 (Bolke and others, 1973, p. 22). Pumpage for irrigation decreased in 1973 by 3,000 acre-feet (3.7 hm^3). About 3,700 acre-feet (4.6 hm^3) more surface water was used for irrigation in 1973 than in 1972. Withdrawals from wells for public supply were less in 1973 because increased flow from springs supplied a larger part of the water.

Water levels rose in the northeastern and most of the southwestern parts of the area and declined in the central and extreme southwestern parts (fig. 36). Rises were caused by large amounts of recharge from runoff in Shoal, Meadow Valley, and Pinto Creeks. The largest rise was northeast of Enterprise near Shoal Creek. The largest decline was in the southeastern part of the area between Meadow Valley and Pinto Creeks, and it reflects the effects of pumpage for irrigation in a part of the area where little surface runoff was available for irrigation or to recharge the aquifer.

The long-term relation between water levels in selected wells, precipitation, and pumpage for irrigation is shown in figure 37. The water level in well (C-35-17)25dcd-1 declined slightly from March 1973 to March 1974, but the decline was relatively small compared to the decline during most years since 1945. The smaller decline was probably a result of increased recharge and decreased pumping.

Figure 38 shows the change in concentration of dissolved solids in the water from three wells. The concentration of dissolved solids increased slightly in 1973 in water from well (C-34-16)28dcc-2 in the northern part of the pumped area and from well (C-36-16)5a-9 near the central part of the pumped area. The increase is a result of continual recycling of return seepage from irrigation in the pumped area where ground water moves toward the central part of the valley from all directions (Bolke and others, 1973, p. 22). The concentration of dissolved solids in water from well (C-37-17)12bdc-1, near Shoal Creek, was considerably less in 1973 than in 1972. The decrease reflects the effects of the large amount of recharge in this area from surface water with a low concentration of dissolved solids.

OTHER AREAS

by R. G. Butler

Estimated total withdrawal of water from wells in areas of Utah outside the major developed ground-water basins was about 79,300 acre-feet (97.8 hm^3) in 1973. This amount is about 700 acre-feet (0.9 hm^3) less than that reported for 1972 (Bolke and others, 1973, p. 23). The decrease is due to a decreased amount of water pumped for irrigation.

From March 1973 to March 1974 water levels rose as a result of above-average precipitation in the Grouse Creek, Curlew, upper Bear River, Bear Lake, Ogden, Cedar, Beaver, and Snake Valleys, and in the Dugway, Monticello, and central Virgin River areas (fig. 39).

Water levels rose in the upper Fremont Valley and in the Blanding area, although precipitation was below average (fig. 39).

Water levels declined in the Heber and lower Bear River Valleys and in the Duchesne River and Vernal areas, although precipitation was above average (fig. 39).

Water levels declined in Park Valley reflecting below-average precipitation (fig. 39).

REFERENCES

Arnow, Ted, and others, 1964, Ground-water conditions in Utah, spring of 1964: Utah Water and Power Board Coop. Inv. Rept. 2, 104 p.

______ 1965, Ground-water conditions in Utah, spring of 1965: Utah Water and Power Board Coop. Inv. Rept. 3, 99 p.

Baker, C. H., Jr., and others, 1969, Ground-water conditions in Utah, spring of 1969: Utah Div. Water Resources Coop. Inv. Rept. 7, 61 p.

Baker, C. H., Jr., Price, Don, and others, 1967, Ground-water conditions in Utah, spring of 1967: Utah Div. Water Resources Coop. Inv. Rept. 5, 89 p.

Bolke, E. L., and others, 1973, Ground-water conditions in Utah, spring of 1973: Utah Div. Water Resources Coop. Inv. Rept. 12, 73 p.

Cordova, R. M., and others, 1968, Ground-water conditions in Utah, spring of 1968: Utah Div. Water Resources Coop. Inv. Rept. 6, 105 p.

______ 1971, Ground-water conditions in Utah, spring of 1971: Utah Div. Water Resources Coop. Inv. Rept. 9, 72 p.

Handy, A. H., Mower, R. W., and Sandberg, G. W., 1969, Changes in chemical quality of ground water in three areas in the Great Basin, Utah, in Geological Survey Research 1969: U.S. Geol. Survey Prof. Paper 650-D, p. D228-D234.

Hood, J. W., and others, 1966, Ground-water conditions in Utah, spring of 1966: Utah Water and Power Board Coop. Inv. Rept. 4, 95 p.

Sumsion, C. T., and others, 1970, Ground-water conditions in Utah, spring of 1970: Utah Div. Water Resources Coop. Inv. Rept. 8, 71 p.

______ 1972, Ground-water conditions in Utah, spring of 1972: Utah Div. Water Resources Coop. Inv. Rept. 10, 73 p.

U.S. Department of Agriculture, 1973, Water supply outlook for Utah as of March 1, 1973: Soil Conservation Service, Salt Lake City, Utah.

ILLUSTRATIONS

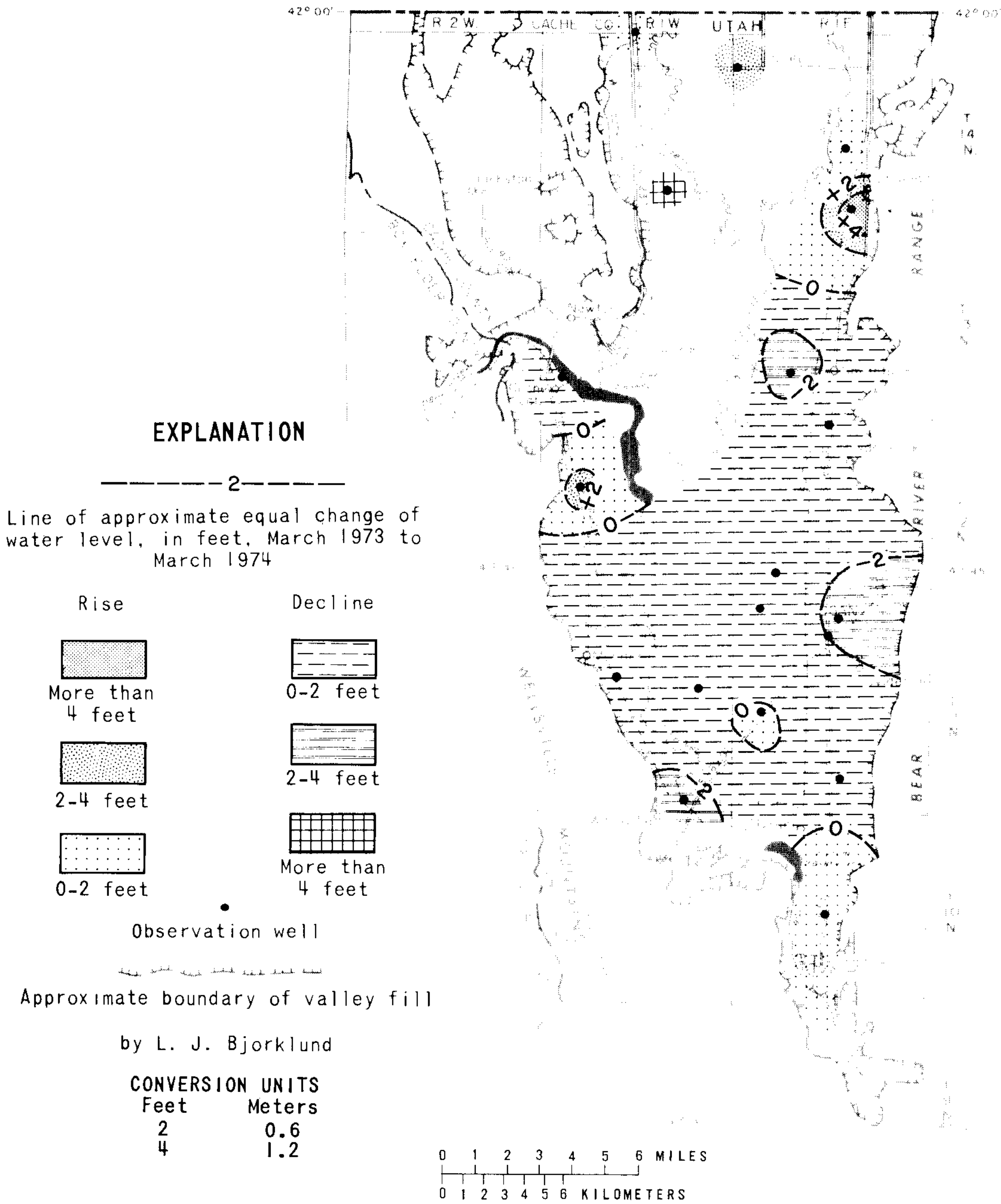


Figure 2.— Map of Cache Valley showing change of water levels from March 1973 to March 1974.

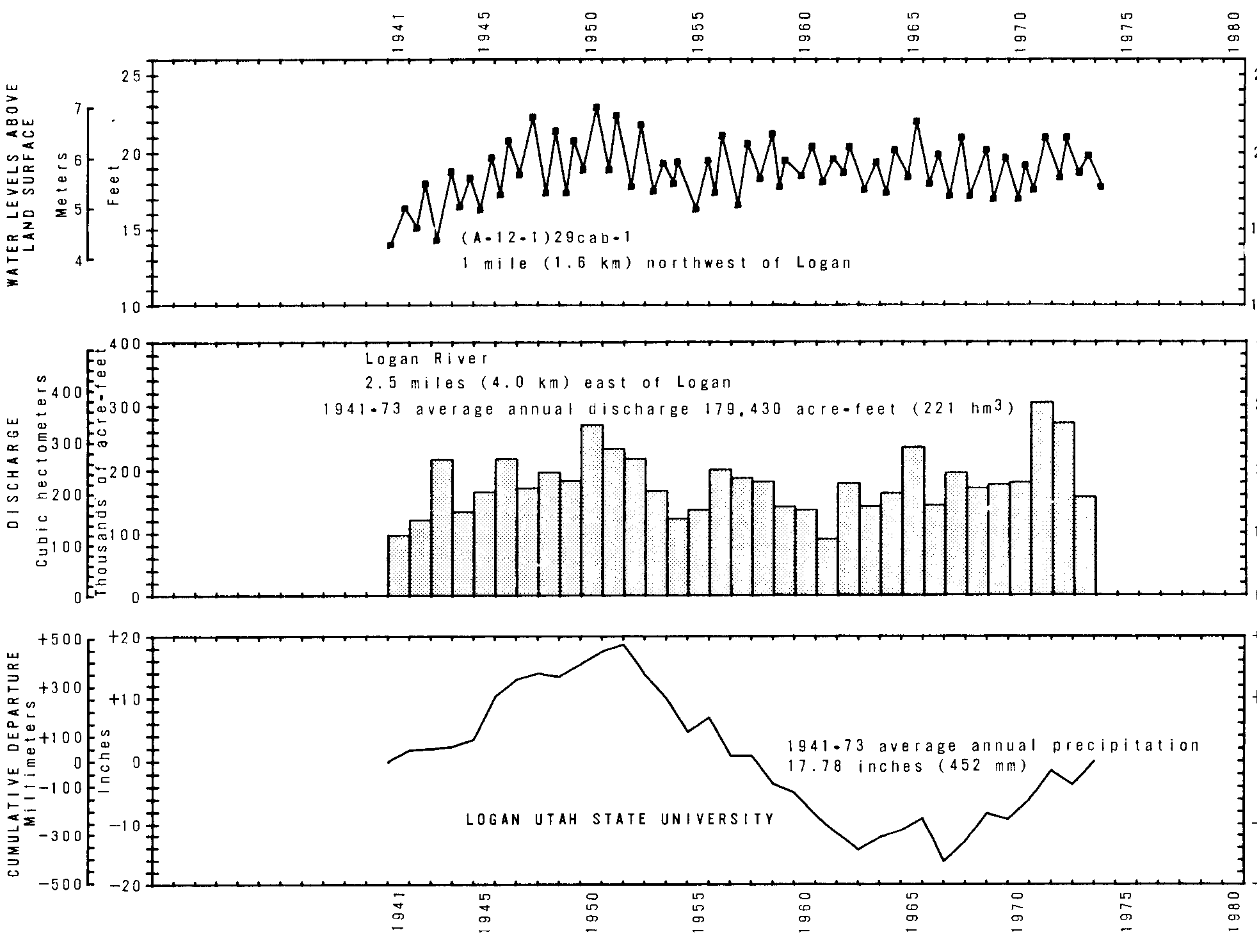


Figure 3.—Relation of water levels in well (A-12-1)29cab-1 in Cache Valley to discharge of the Logan River near Logan and to cumulative departure from the average annual precipitation at Logan Utah State University.

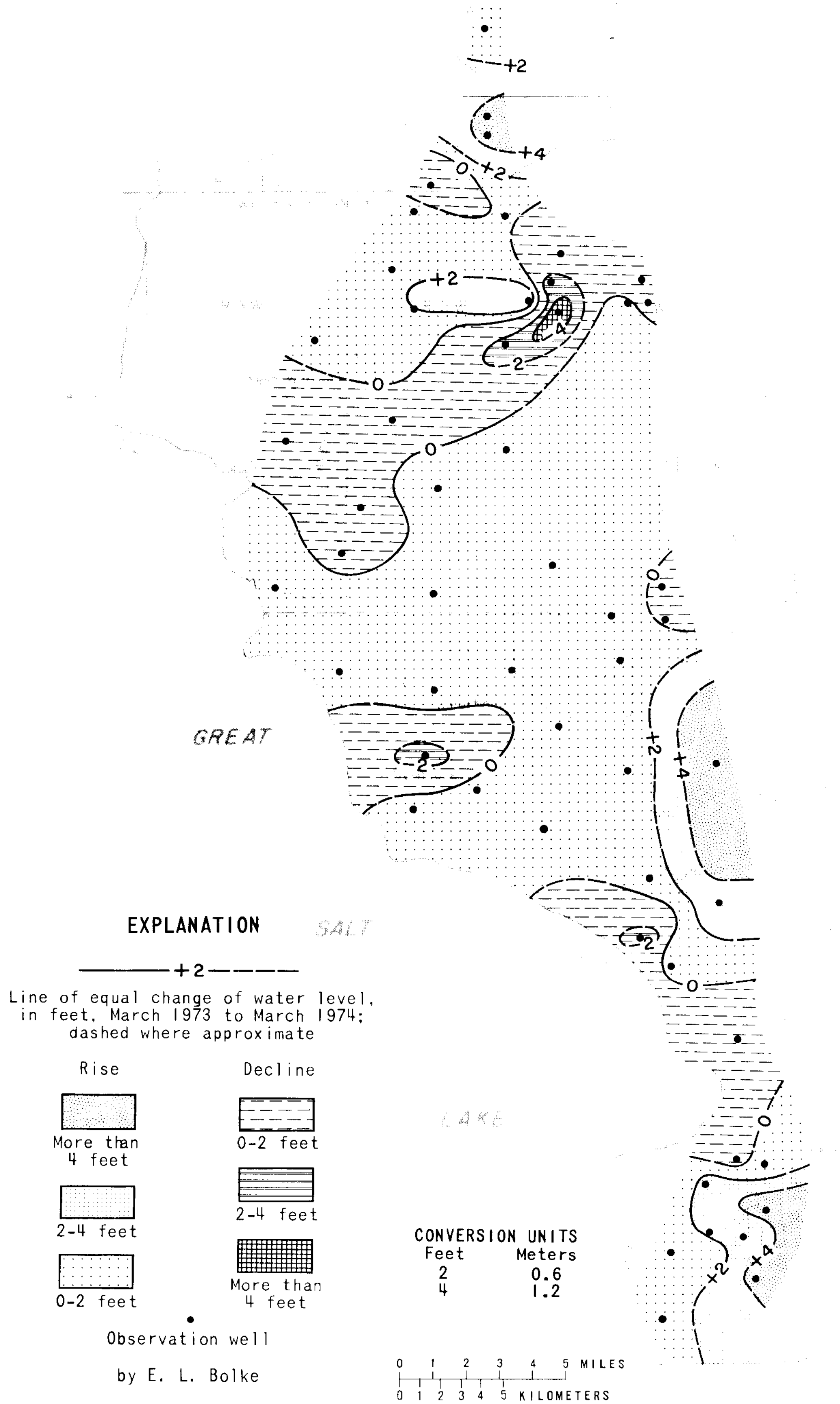
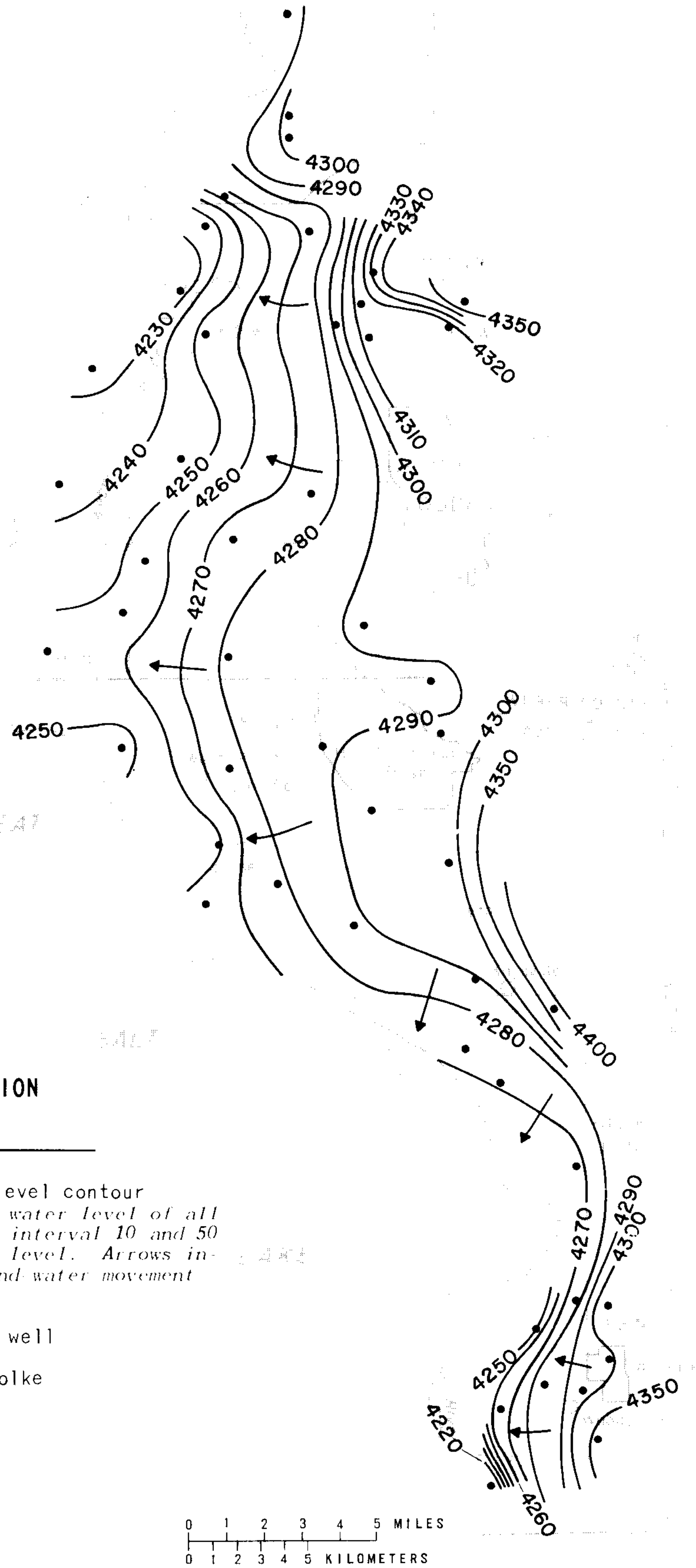


Figure 4.—Map of the East Shore area showing change of water levels from March 1973 to March 1974.



CONVERSION UNITS

Feet	Meters
4220	1286
4230	1289
4240	1292
4250	1295
4260	1298
4270	1301
4280	1304
4290	1307
4300	1310
4310	1313
4320	1316
4330	1319
4340	1322
4350	1325
4400	1341

EXPLANATION

4280

Approximate water-level contour
Shows general altitude of water level of all major aquifers. Contour interval 10 and 50 feet. Datum is mean sea level. Arrows indicate direction of ground-water movement

Observation well

by E. L. Bolke

Figure 5.—Map of the East Shore area showing generalized water-level contours, March 1974.

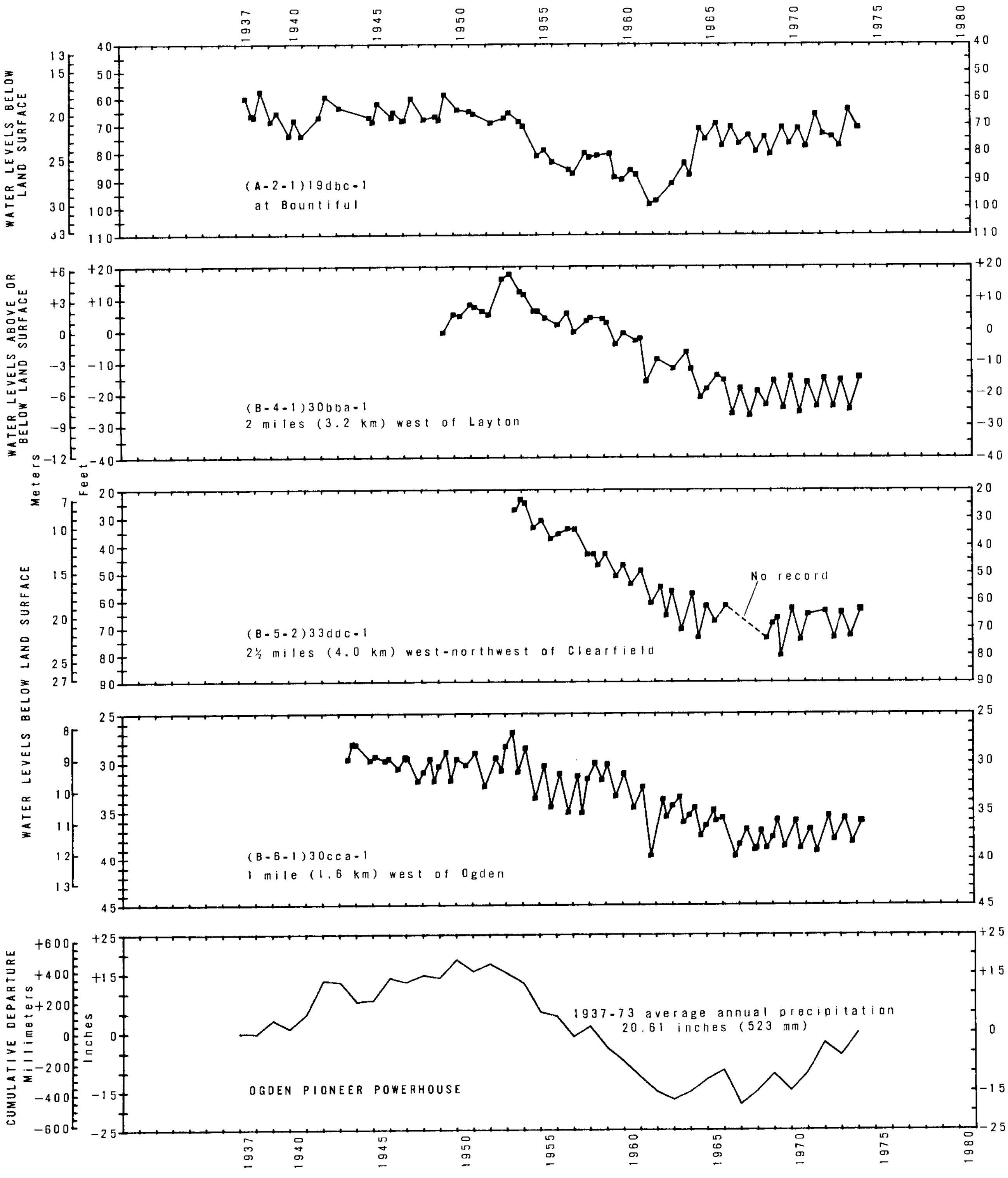


Figure 6.—Relation of water levels in selected wells in the East Shore area to cumulative departure from the average annual precipitation at Ogden Pioneer powerhouse.

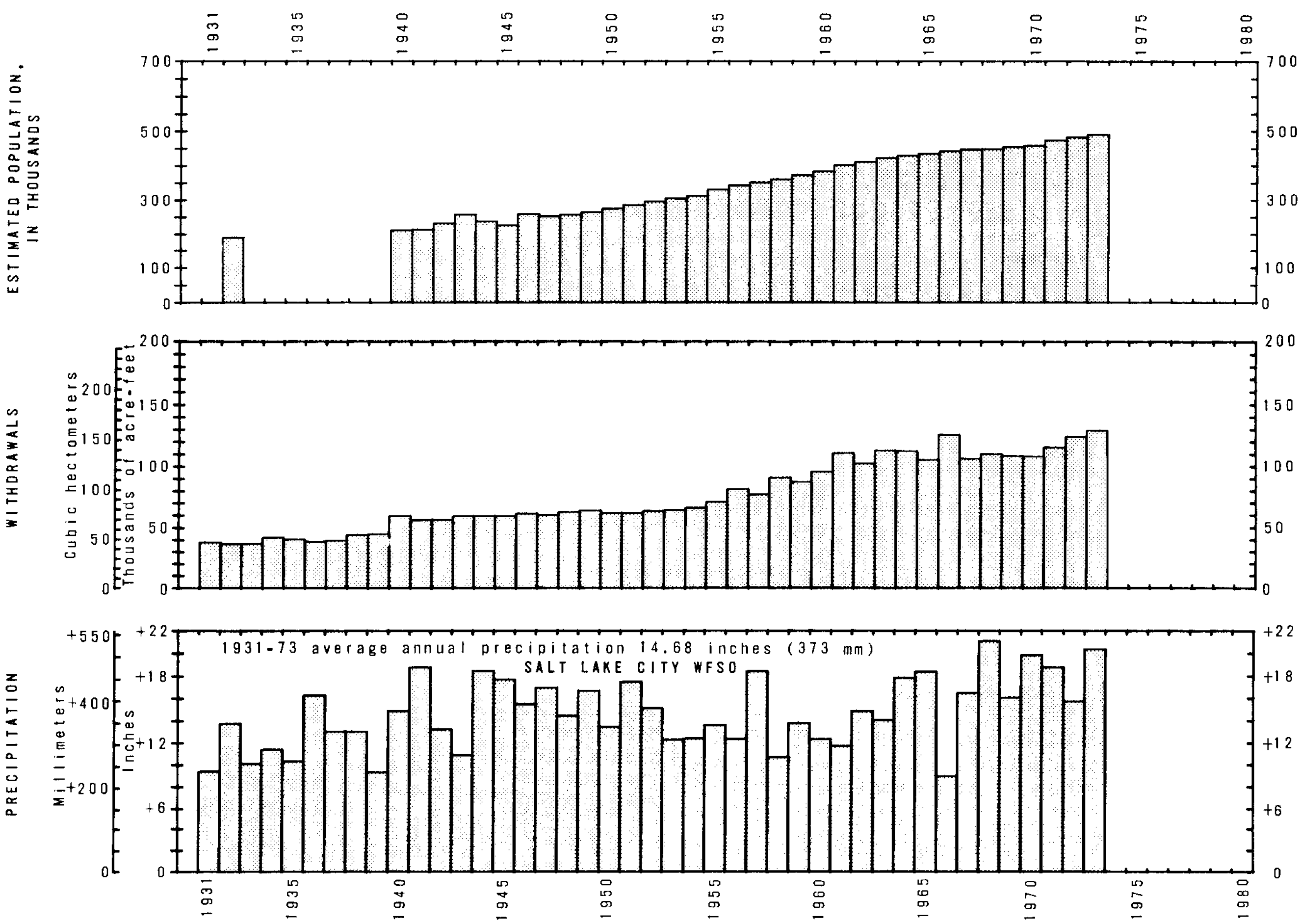


Figure 7.—Graphs showing estimated population of Salt Lake County, withdrawals from wells, and annual precipitation at Salt Lake City WFSO (International Airport) for the period 1931-73.

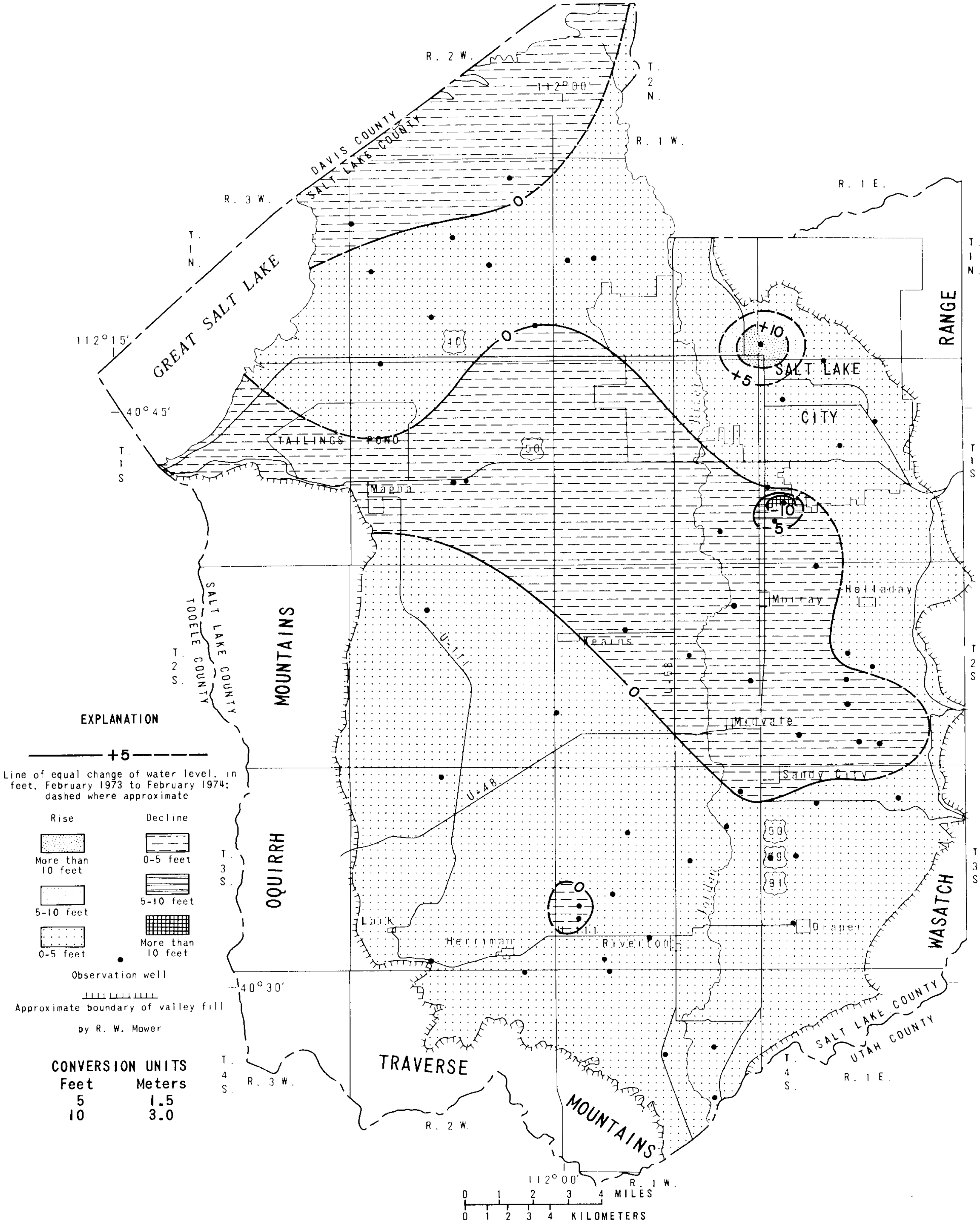


Figure 8.— Map of the Jordan Valley showing change of water levels from February 1973 to February 1974.

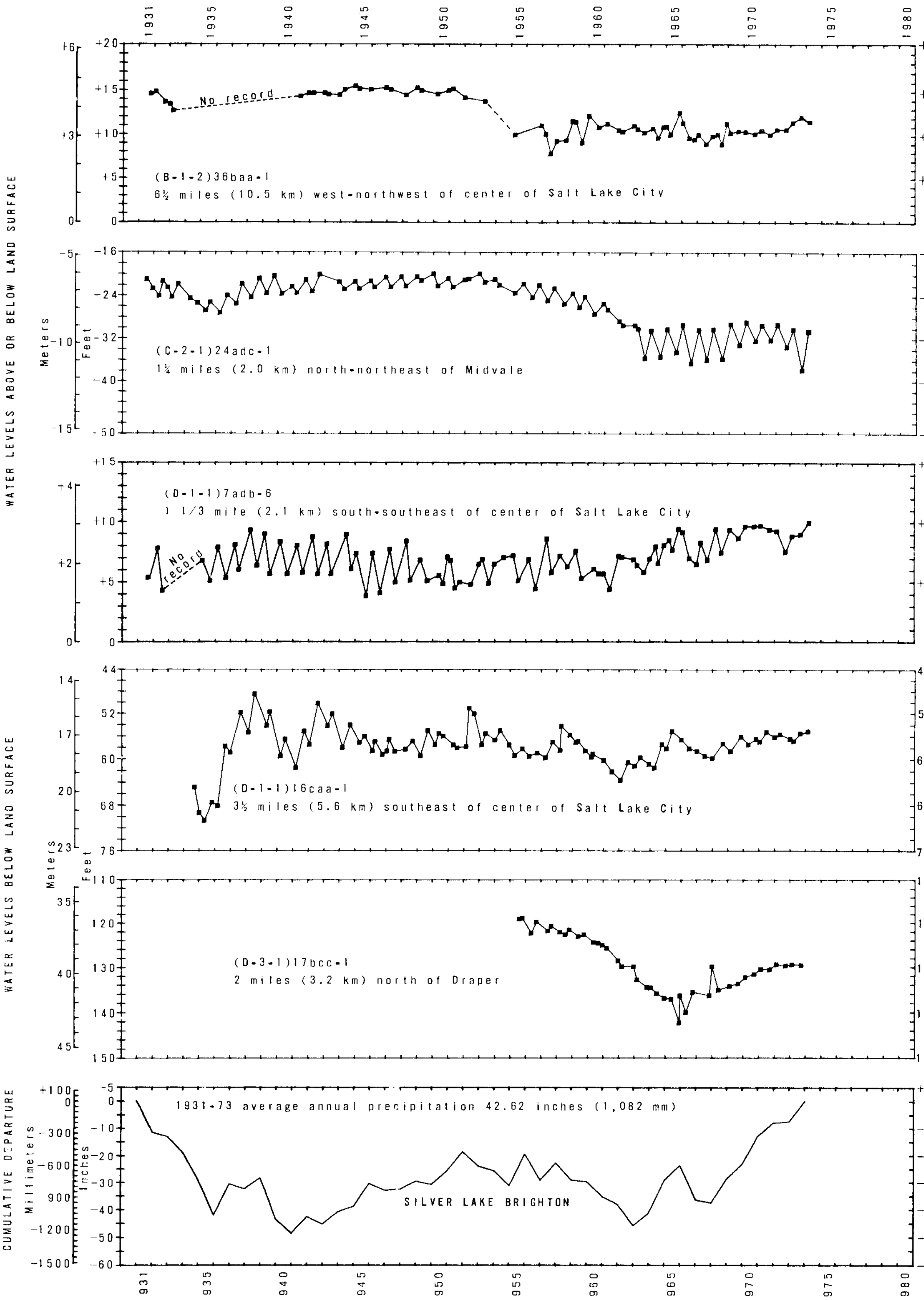


Figure 9.—Relation of water levels in selected wells in the Jordan Valley to cumulative departure from the average annual precipitation at Silver Lake Brighton.

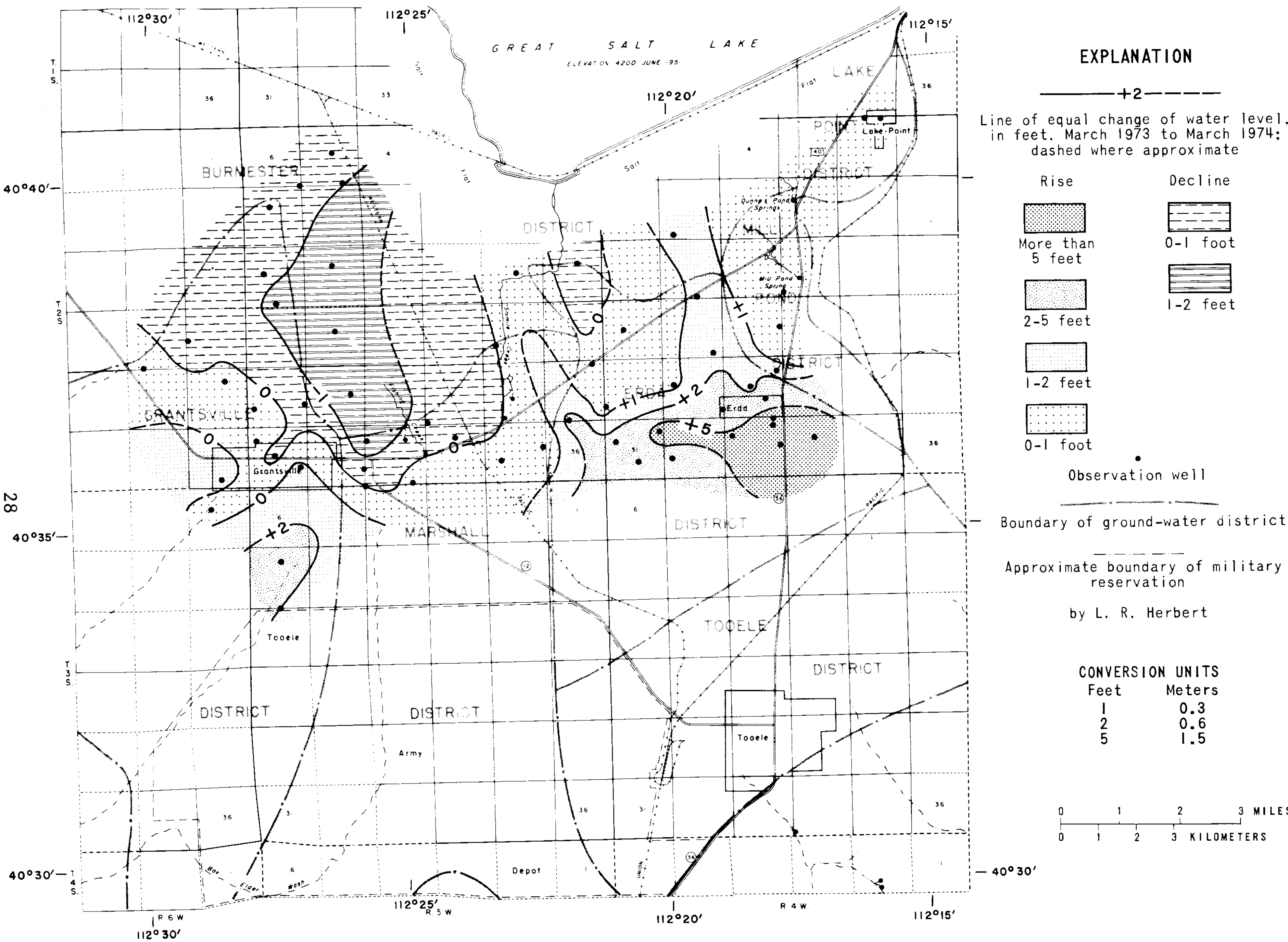


Figure 10.- Map of Tooele Valley showing change of water levels in artesian aquifers from March 1973 to March 1974.

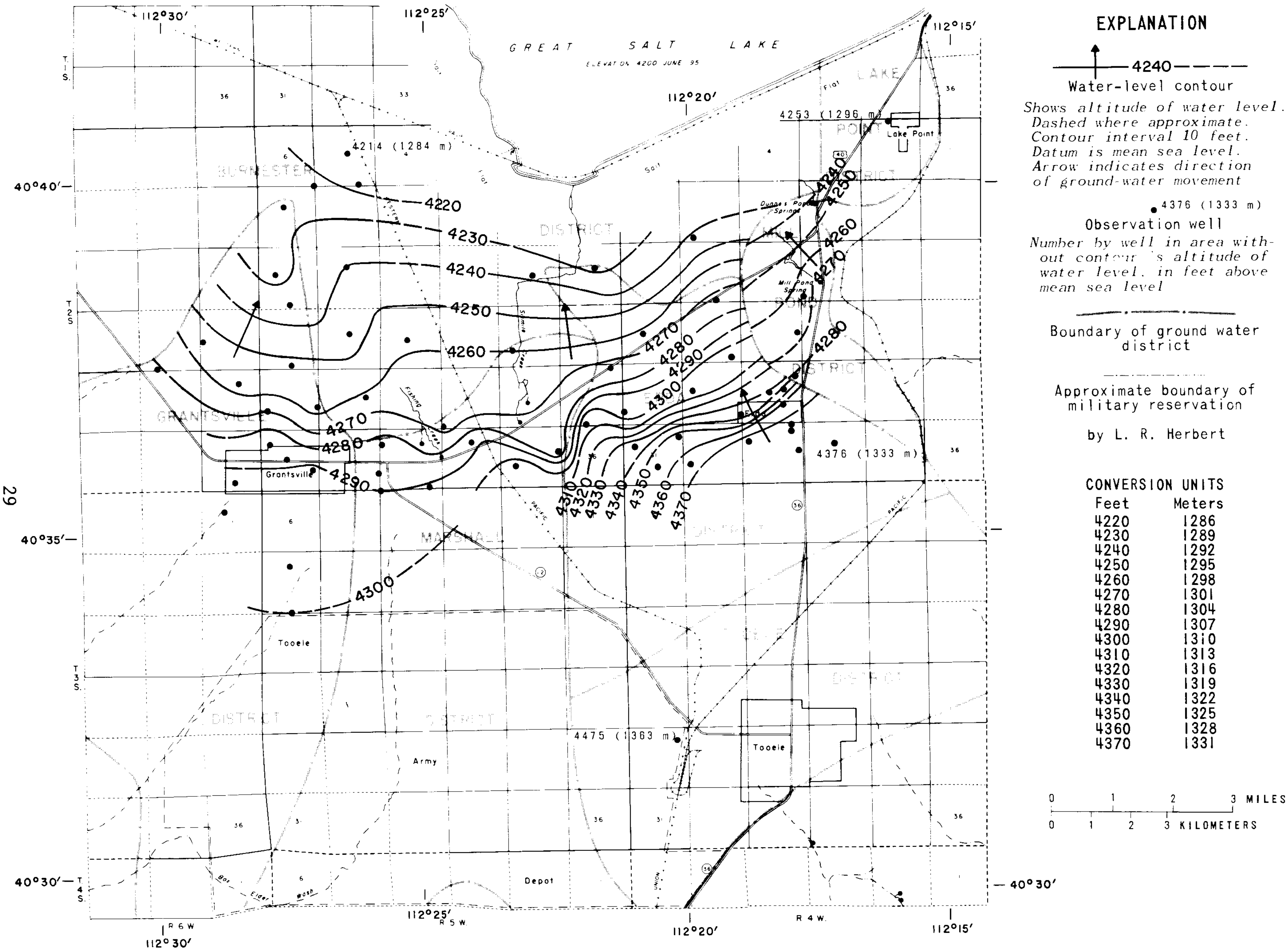


Figure 11.— Map of Tooele Valley showing water-level contours. March 1974.

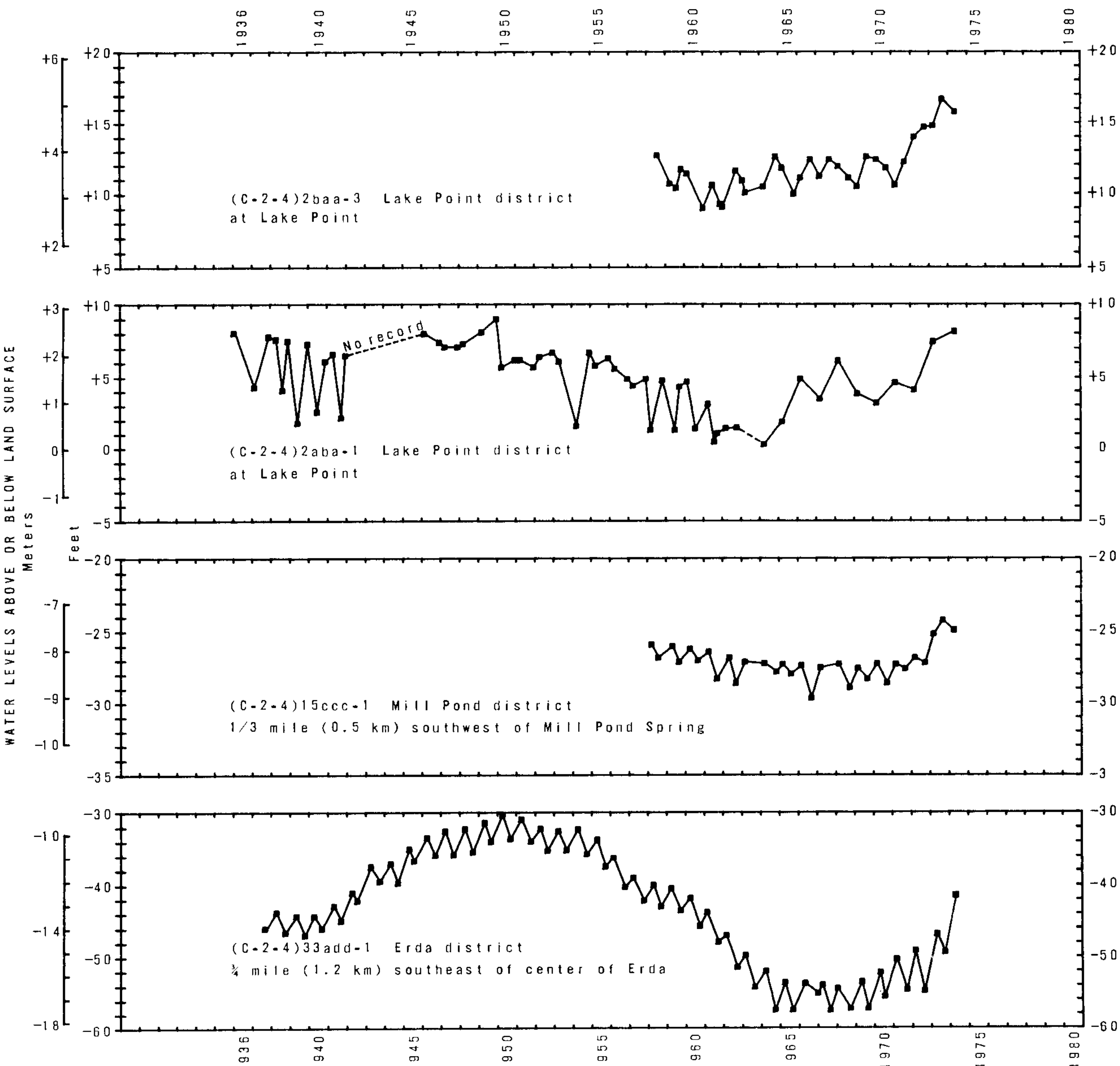


Figure 12.—Relation of water levels in selected wells in Tooele Valley to cumulative departure from the average annual precipitation at Tooele.

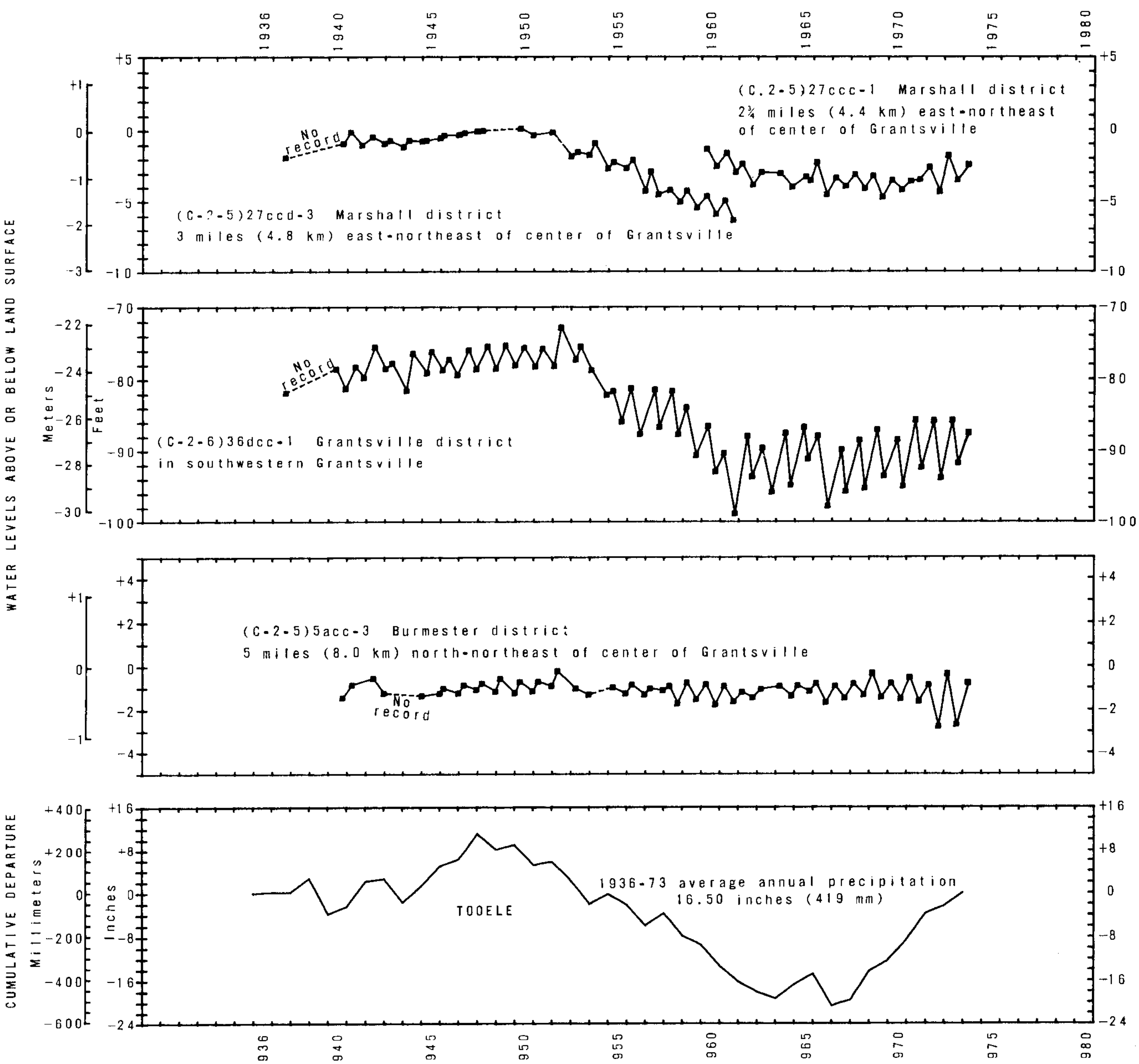
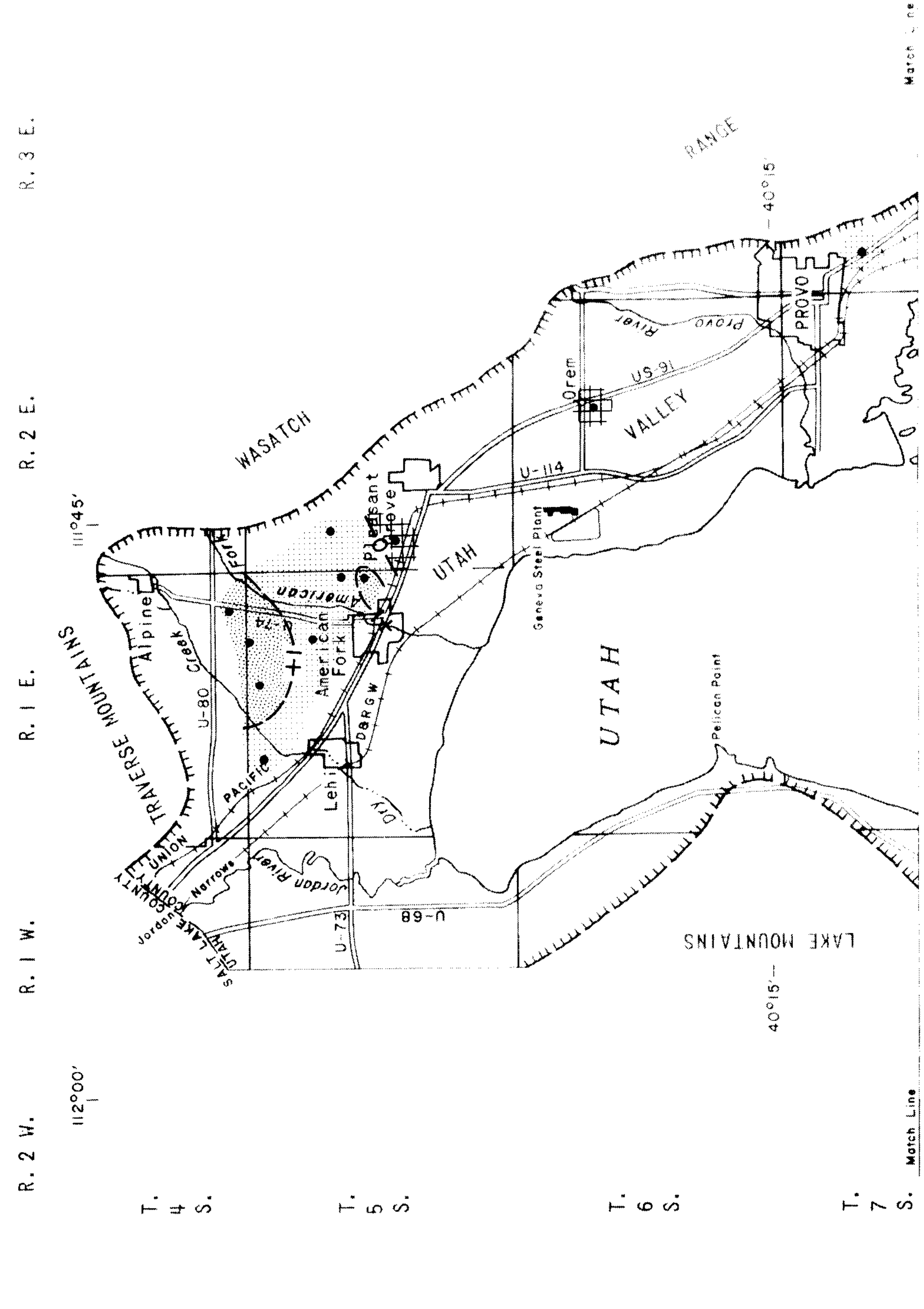


Figure 12.— Continued.



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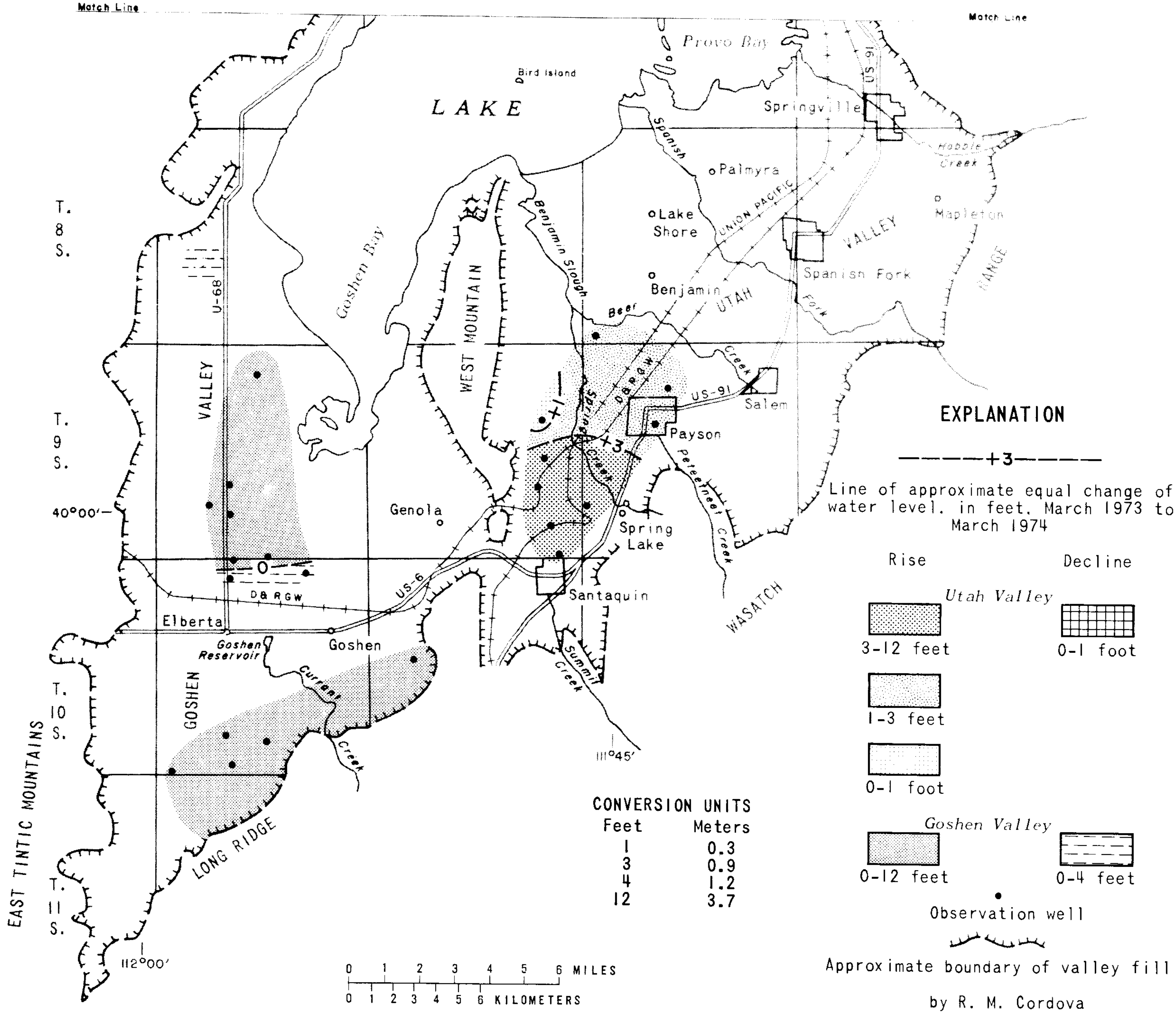
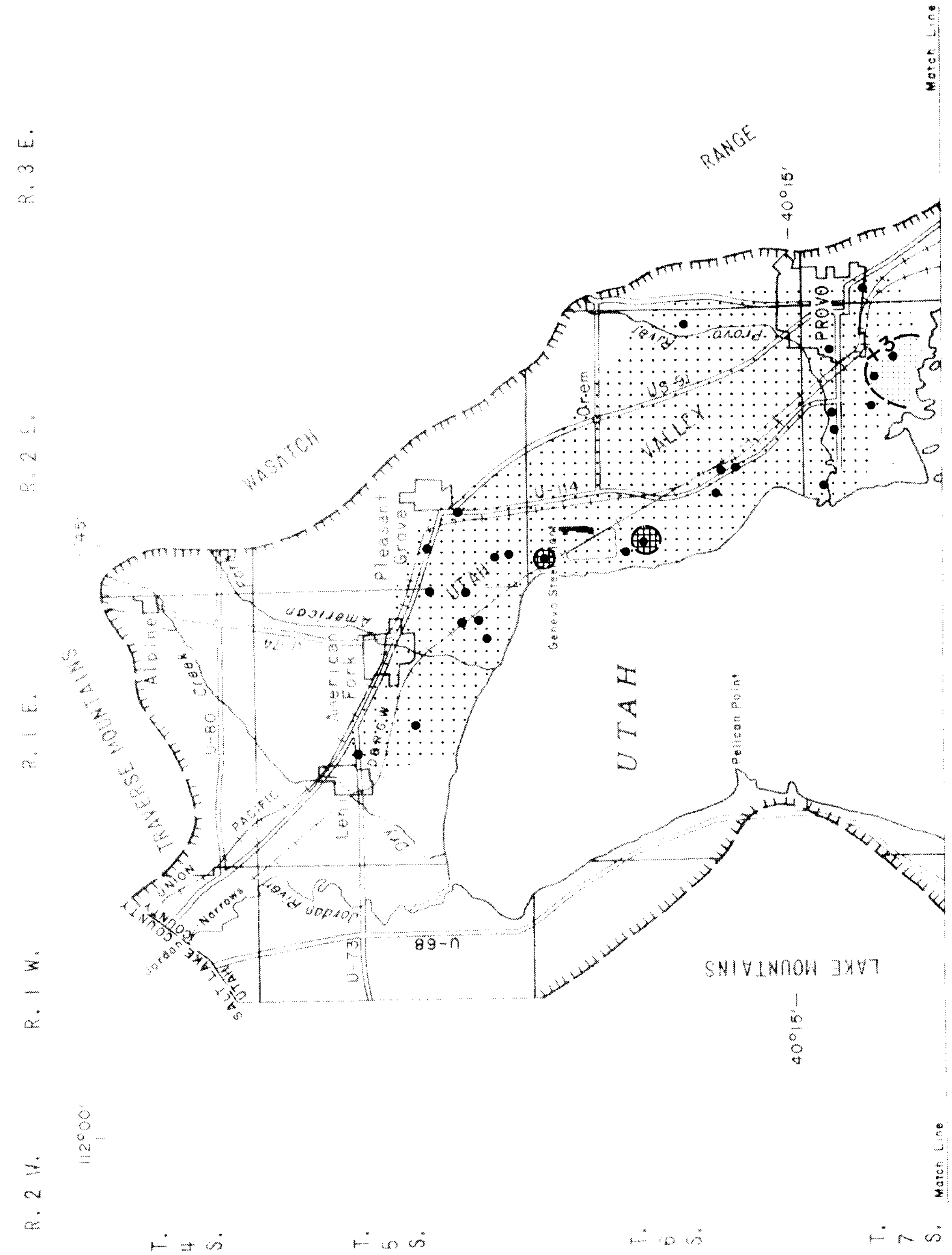


Figure 13.– Map of Utah and Goshen Valleys showing change of water levels in the water-table aquifers from March 1973 to March 1974.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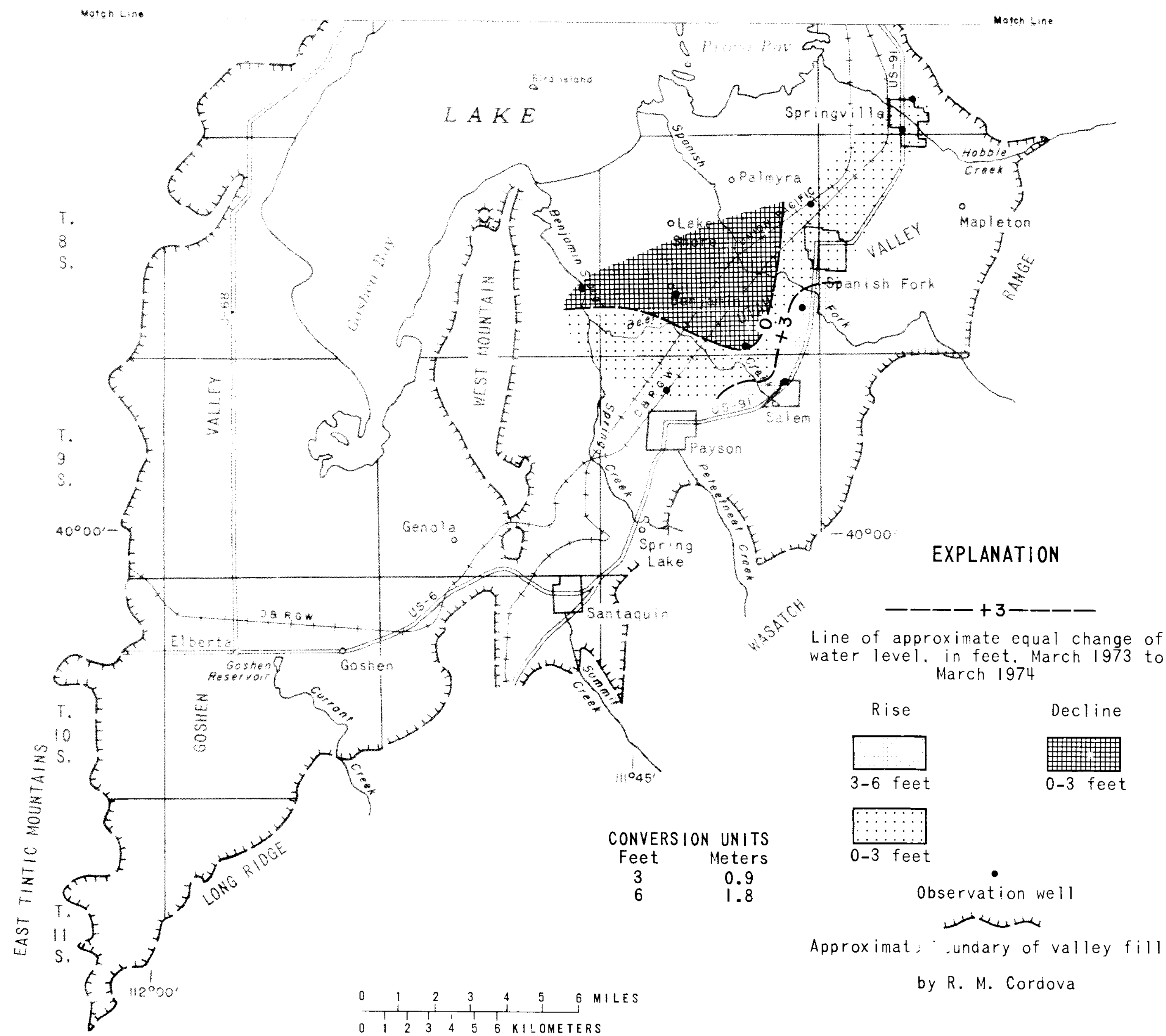
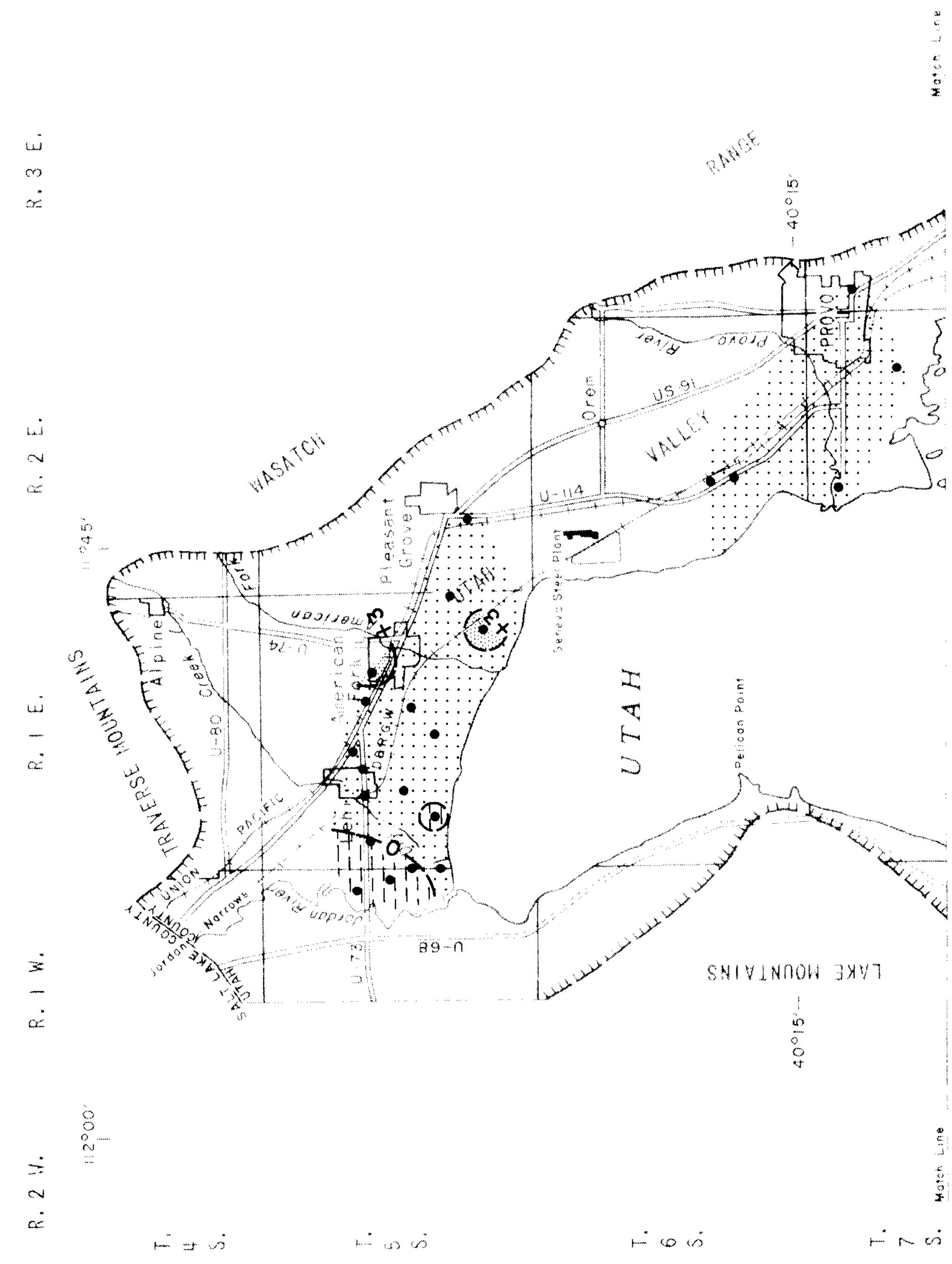


Figure 14.- Map of Utah and Goshen Valleys showing change of water levels in the shallow artesian aquifer in rocks of Pleistocene age from March 1973 to March 1974.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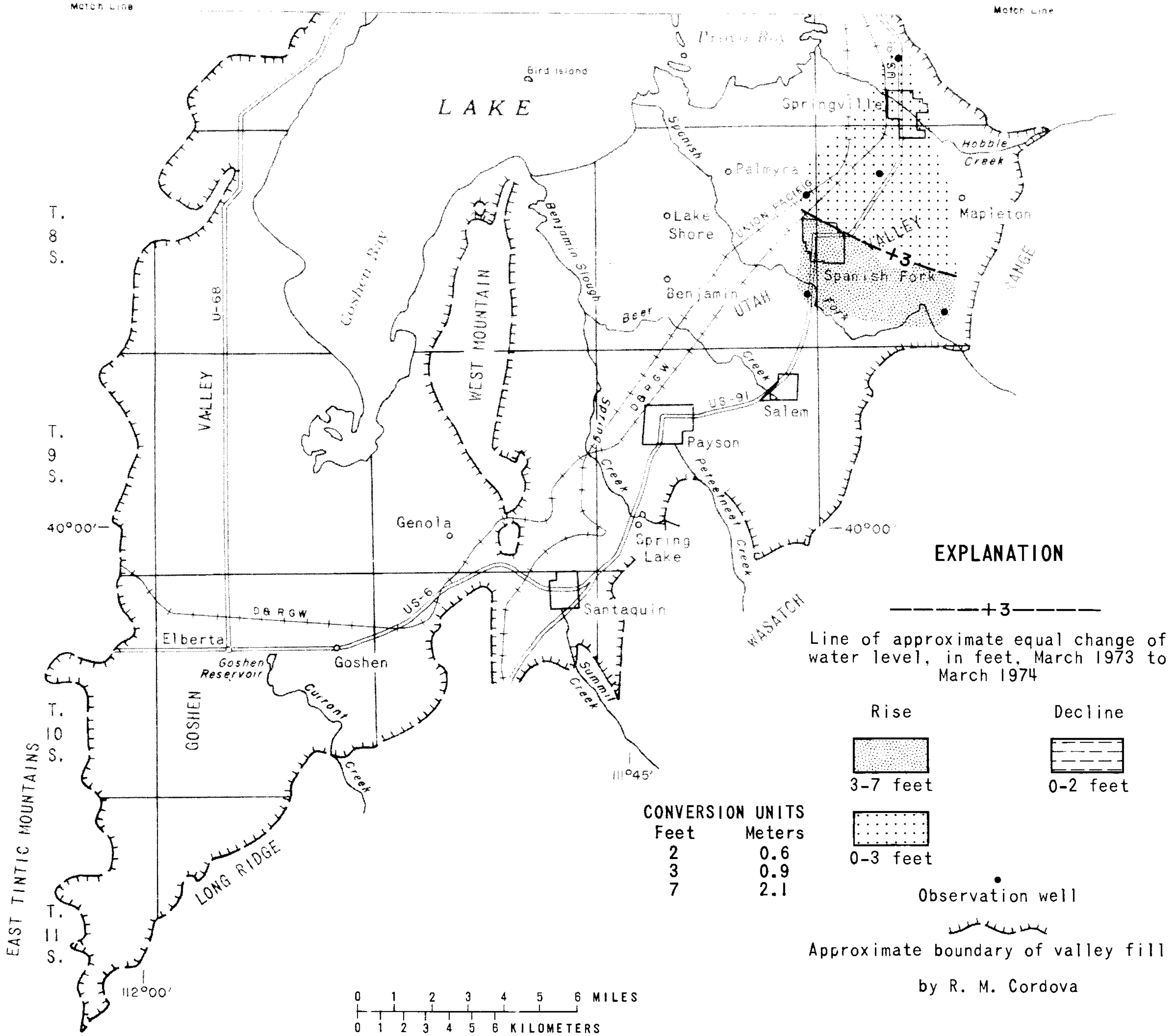
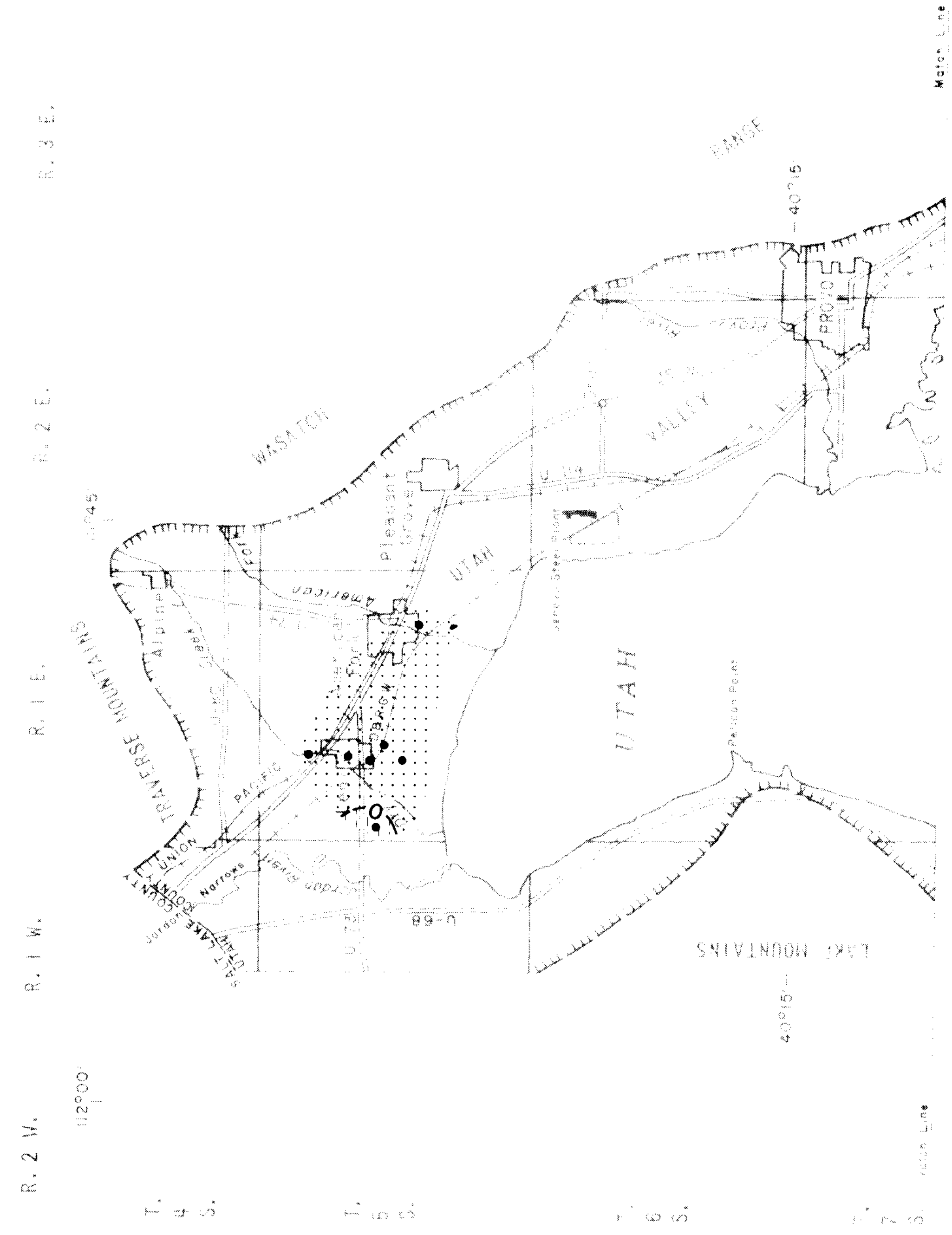


Figure 15.— Map of Utah and Goshen Valleys showing change of water levels in the deep artesian aquifer in rocks of Pleistocene age from March 1973 to March 1974.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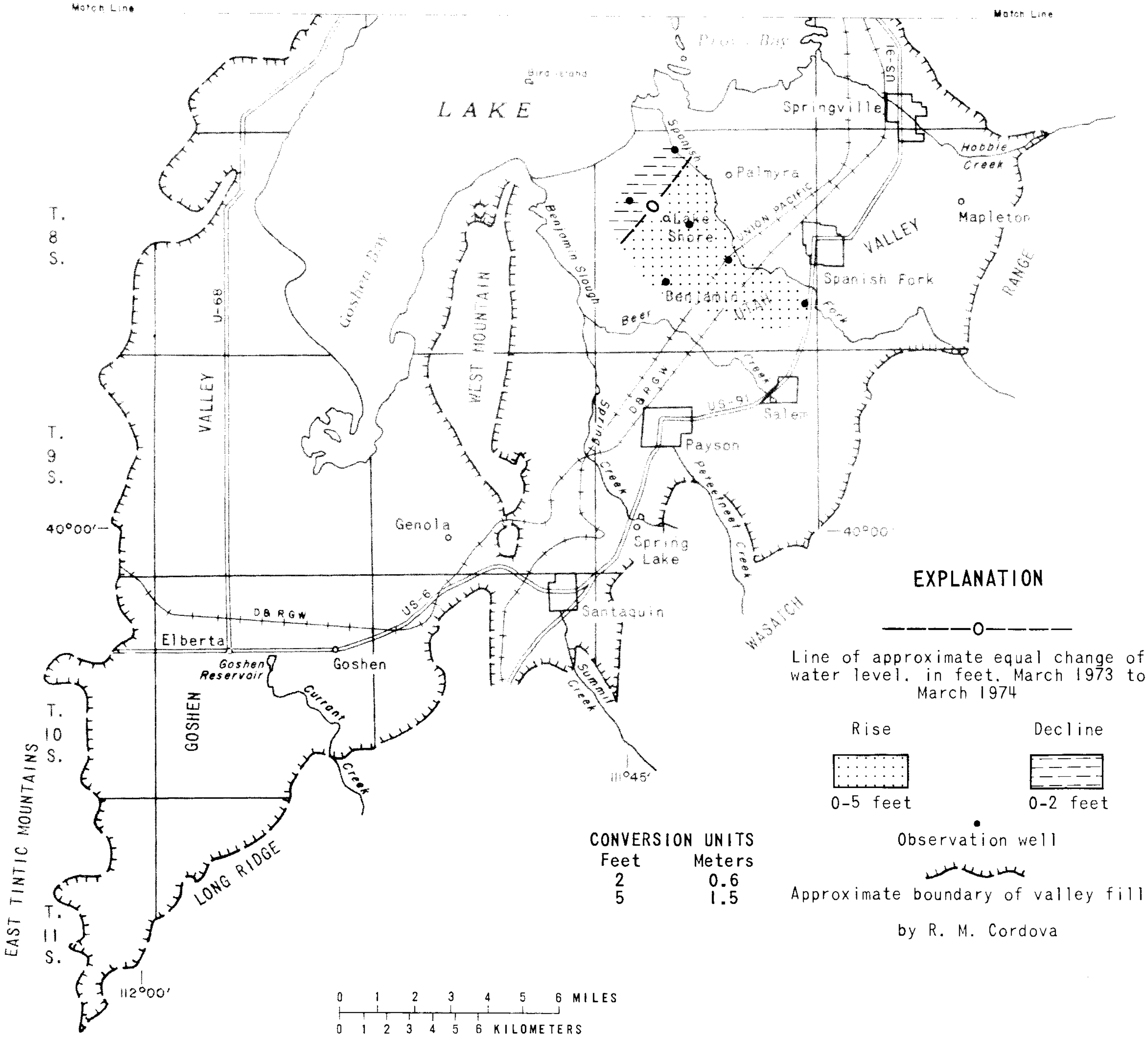


Figure 16.- Map of Utah and Goshen Valleys showing change of water levels in the artesian aquifer in rocks of Tertiary age from March 1973 to March 1974.

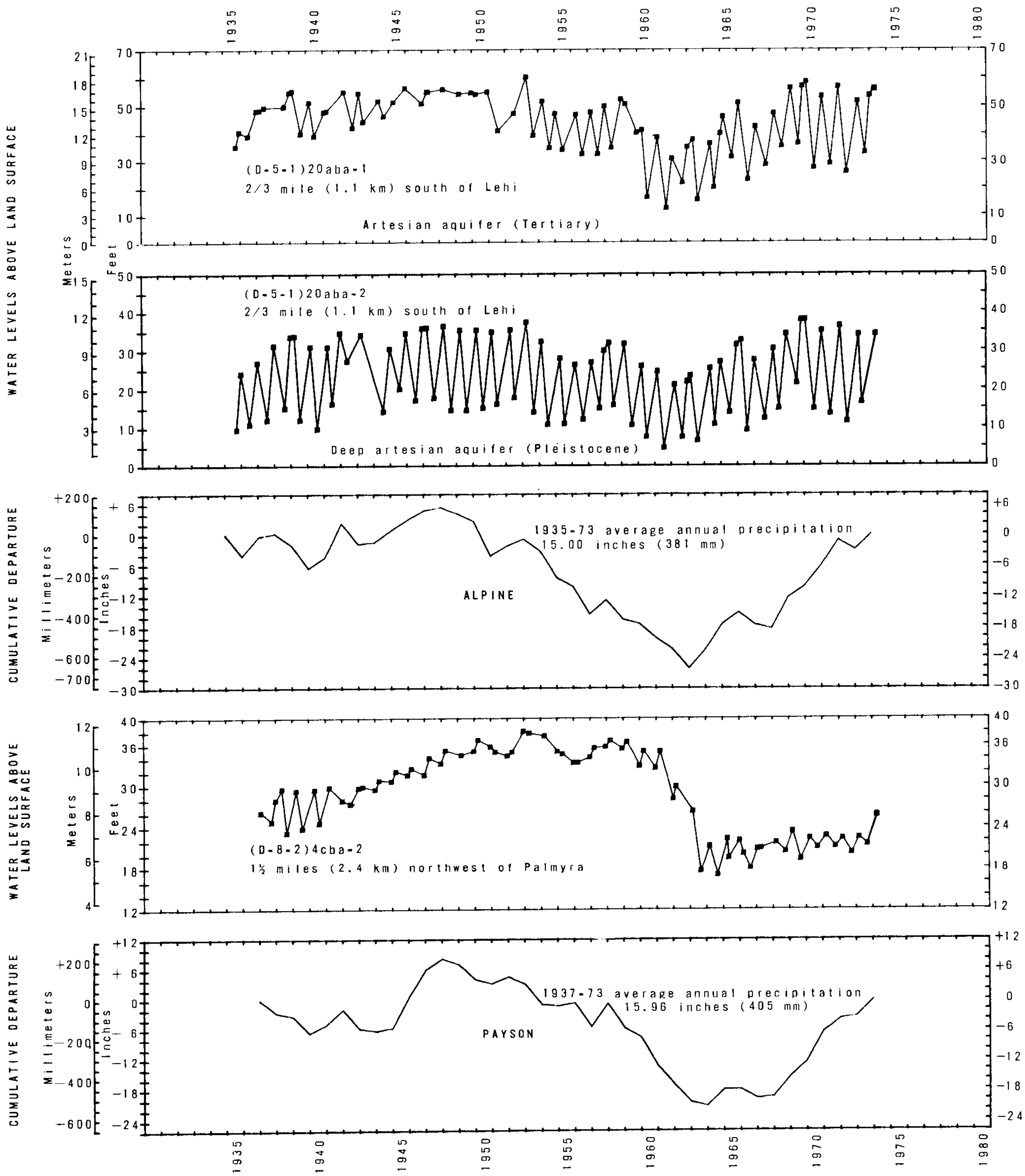
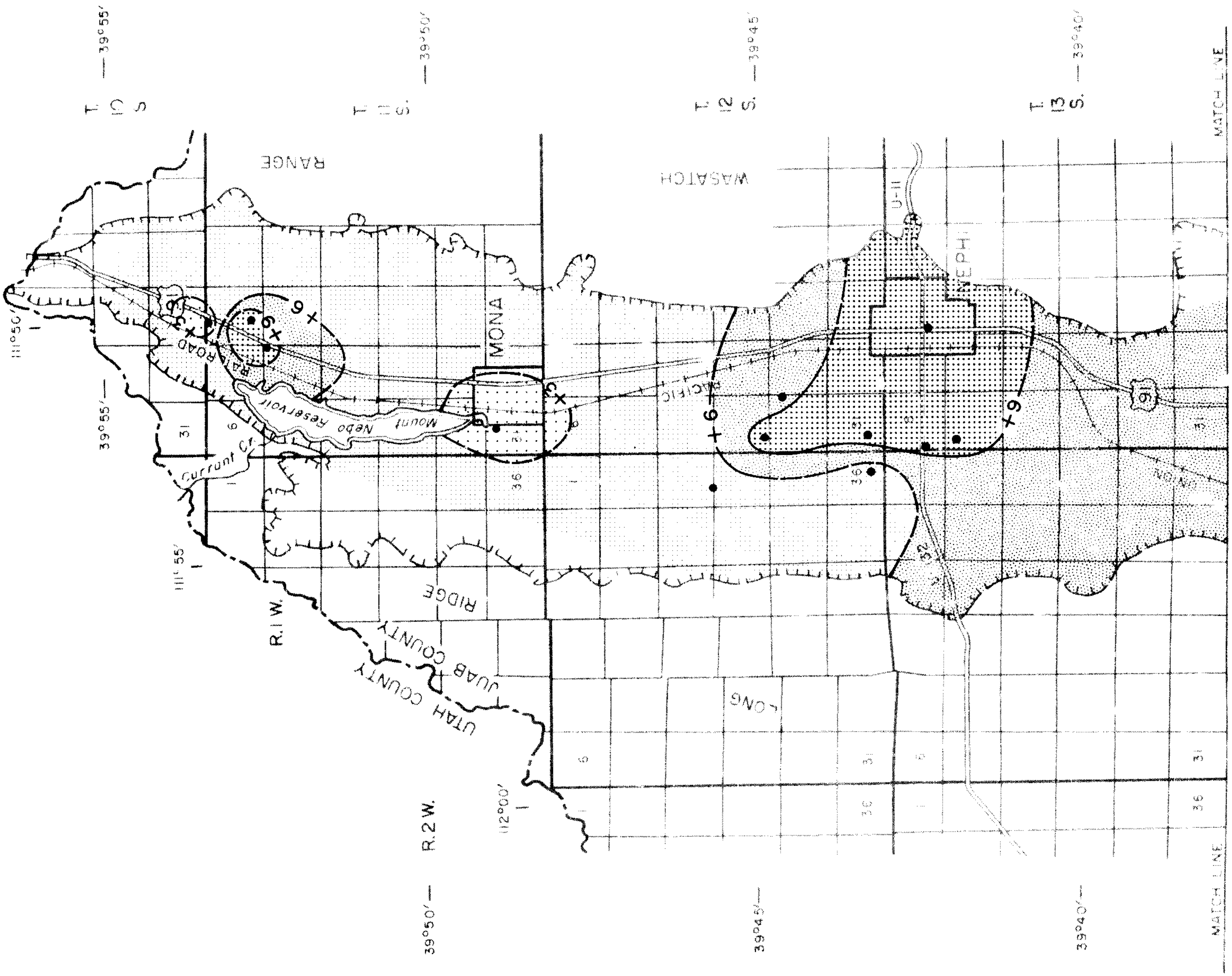


Figure 17.—Relation of water levels in selected wells in Utah Valley to cumulative departure from the average annual precipitation at Alpine and Payson.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JUAB COUNTY
UTAH COUNTY
MATCH LINE
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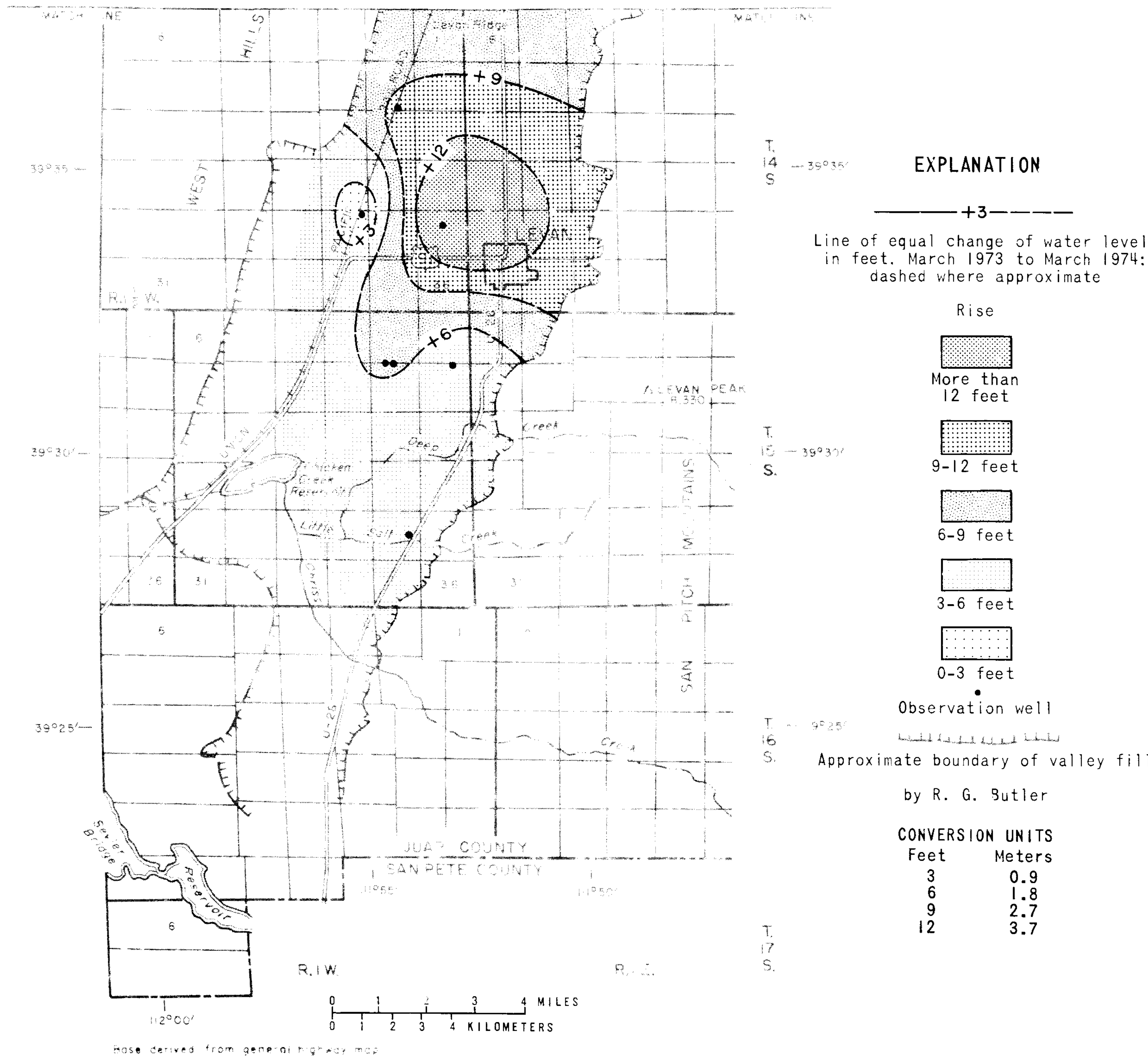


Figure 18.— Map of Juab Valley showing change of water levels from March 1973 to March 1974.

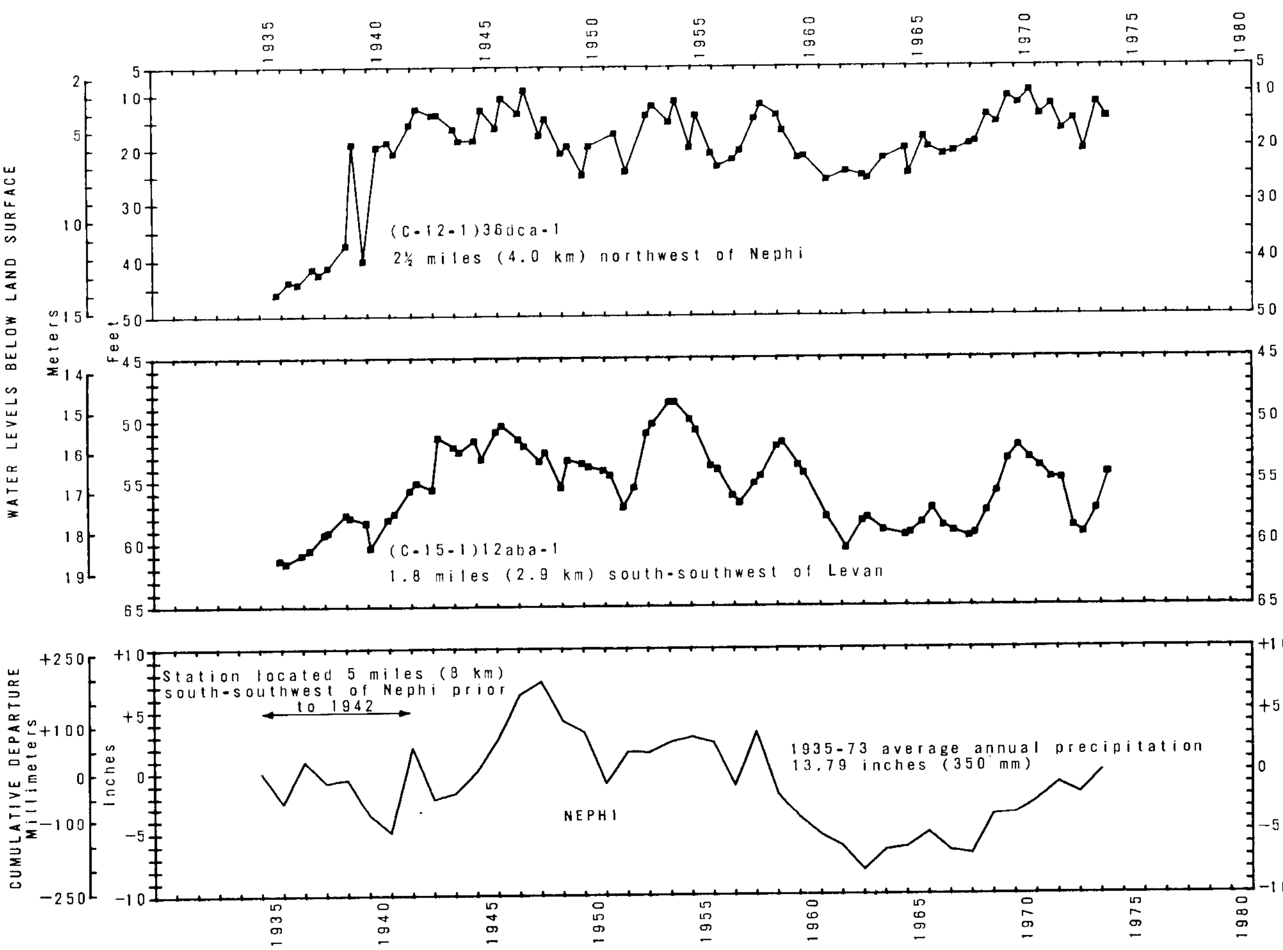


Figure 19.—Relation of water levels in selected wells in Juab Valley to cumulative departure from the average annual precipitation at Nephi.

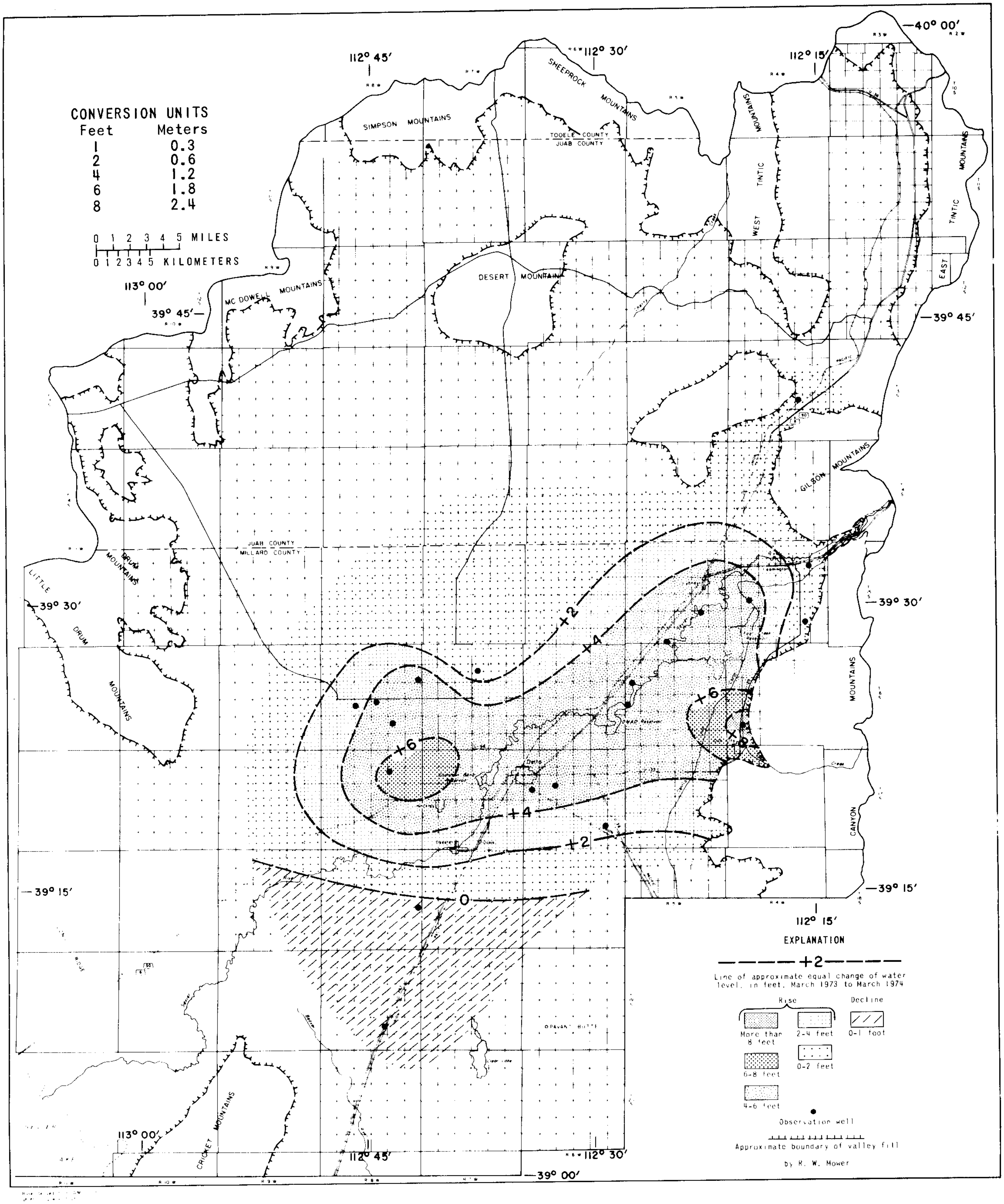


Figure 20.— Map of part of the Sevier Desert showing change of water levels in the lower artesian aquifer from March 1973 to March 1974.

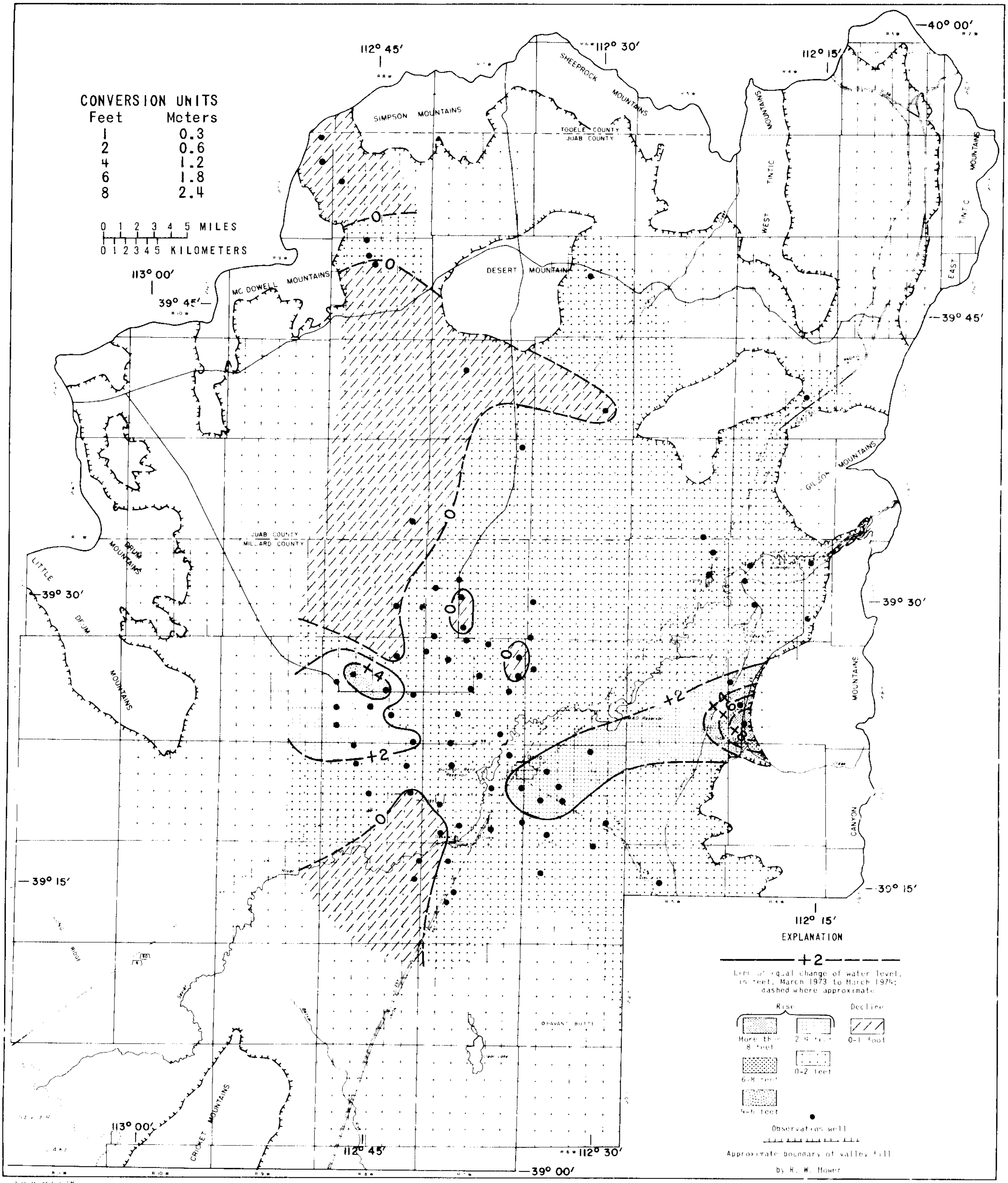


Figure 21.— Map of part of the Sevier Desert showing change of water levels in the upper artesian aquifer from March 1973 to March 1974.

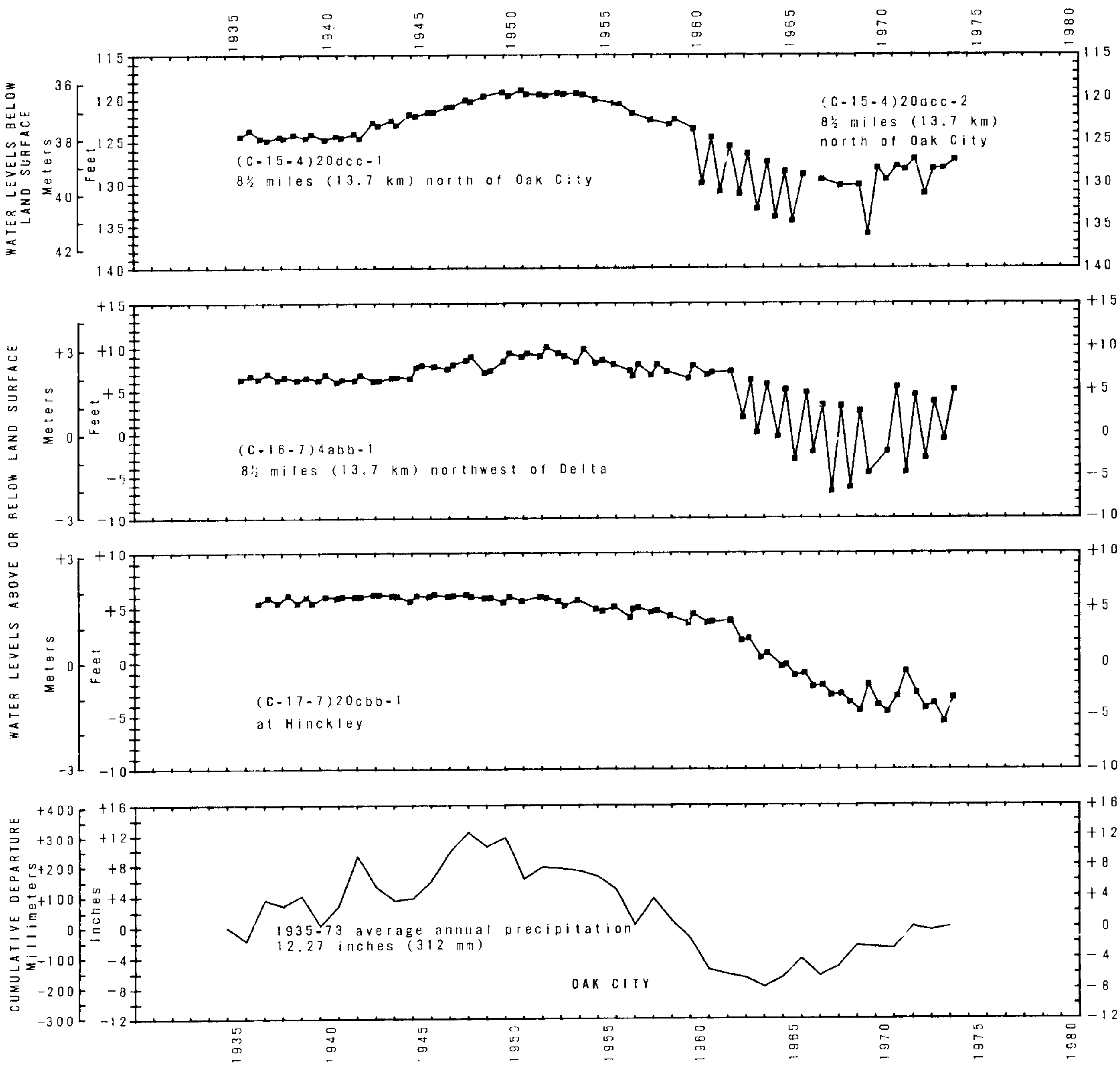


Figure 22.—Relation of water levels in selected wells in the Sevier Desert to cumulative departure from the average annual precipitation at Oak City.

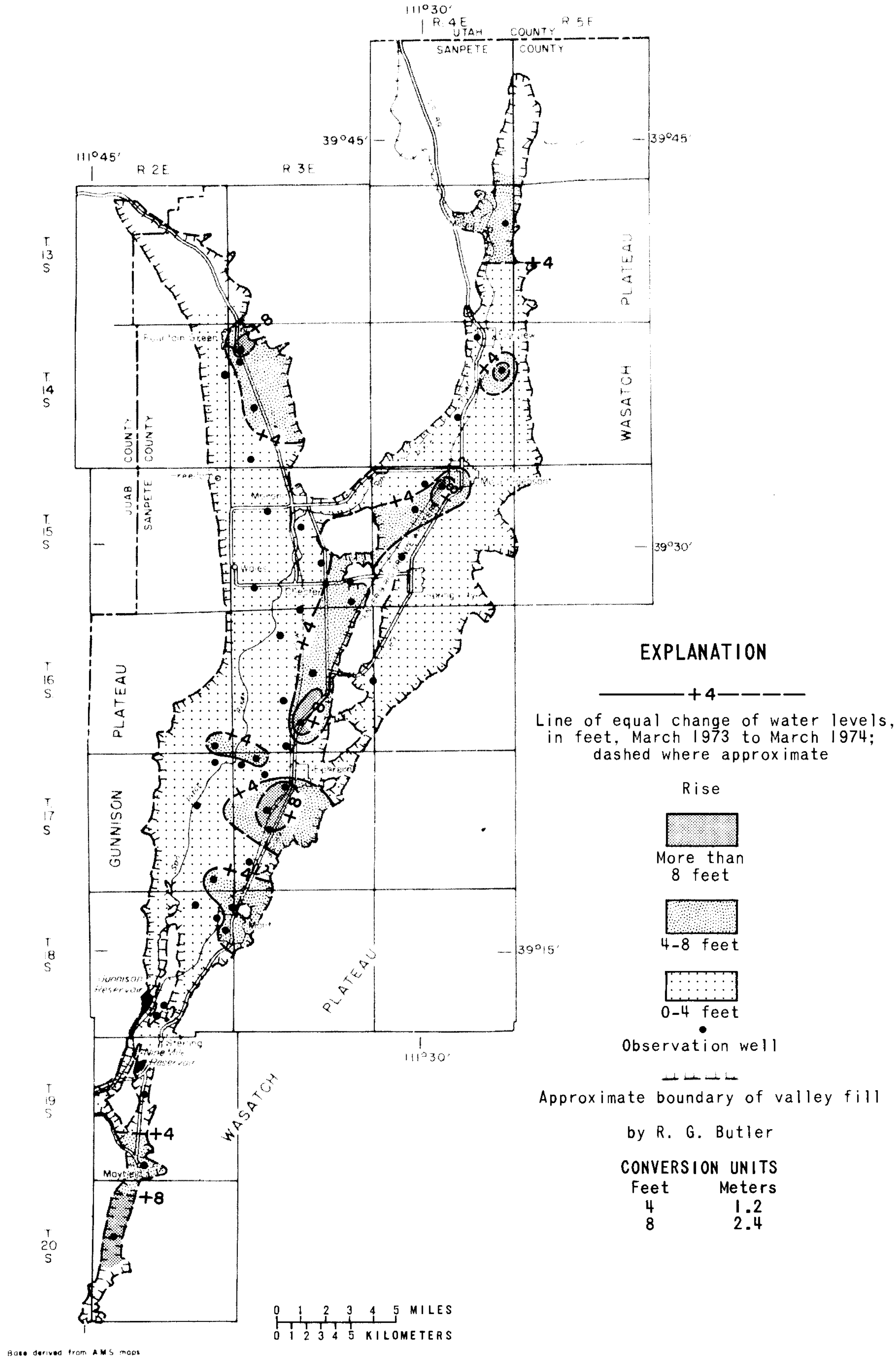


Figure 23.– Map of Sanpete Valley showing change of water levels from March 1973 to March 1974.

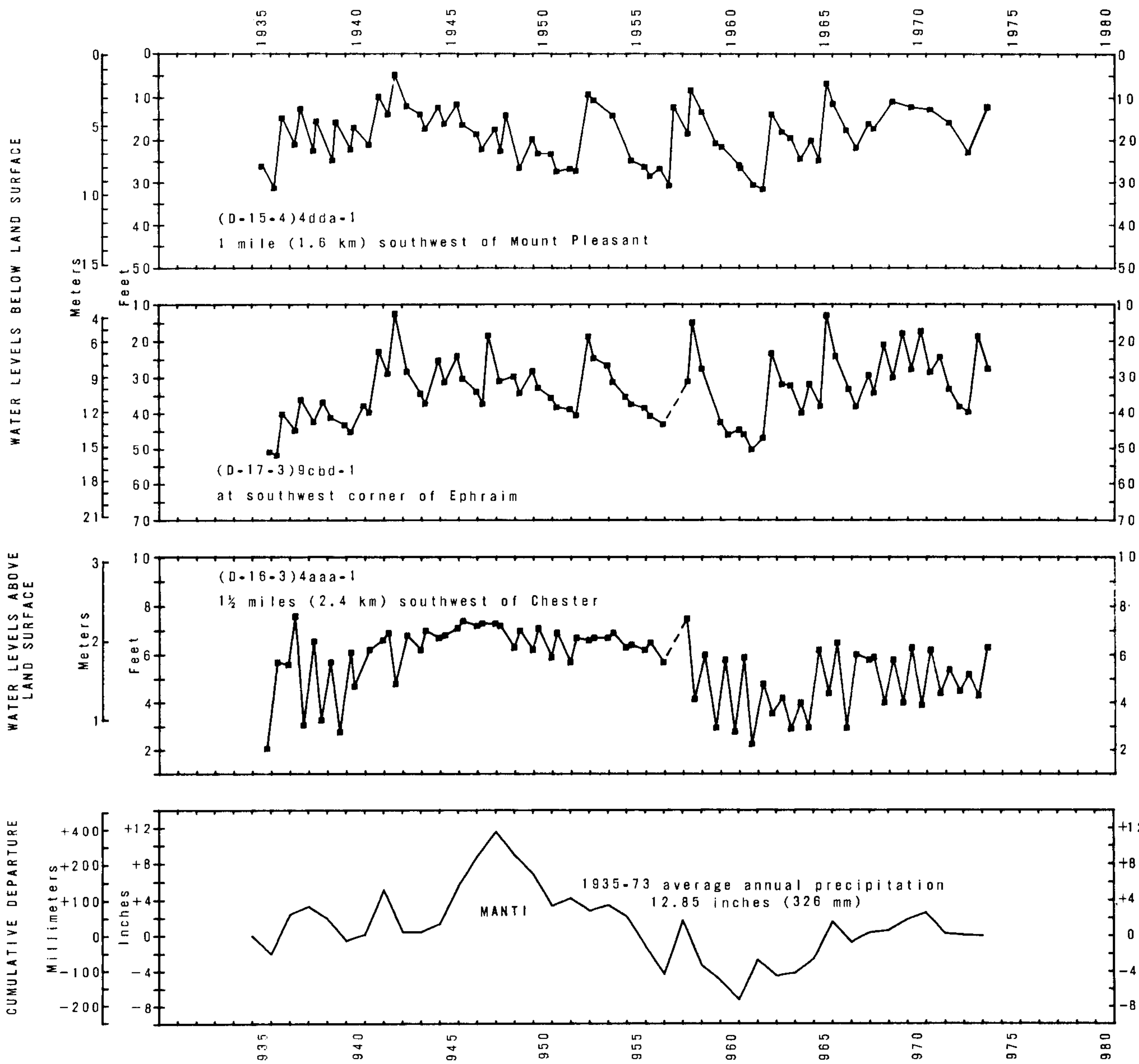
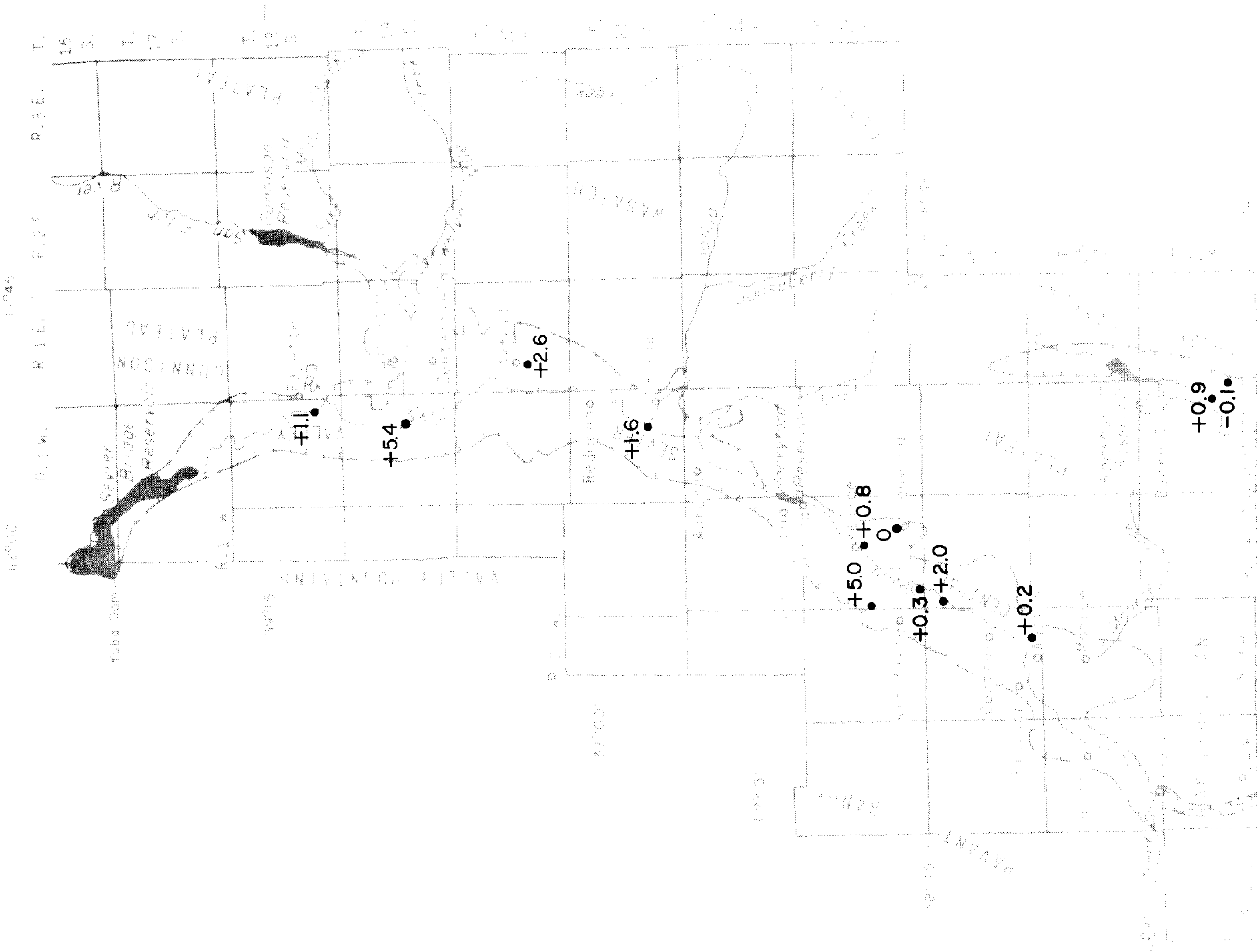


Figure 24.— Relation of water levels in selected wells in Sanpete Valley to cumulative departure from the average annual precipitation at Manti.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+5.4
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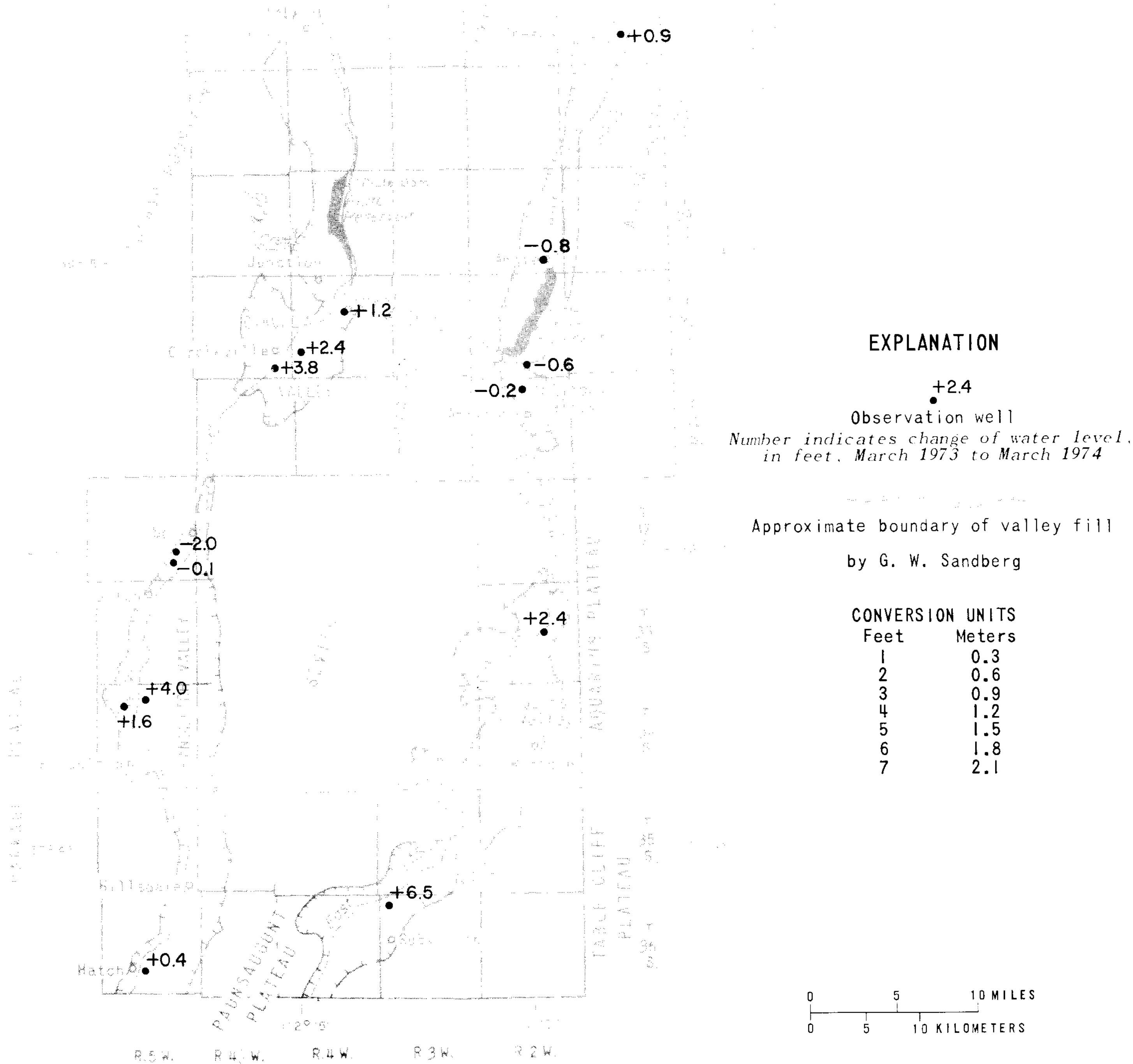

Figure 25.– Map of the upper and central Sevier Valleys showing change of water levels from March 1973 to March 1974.

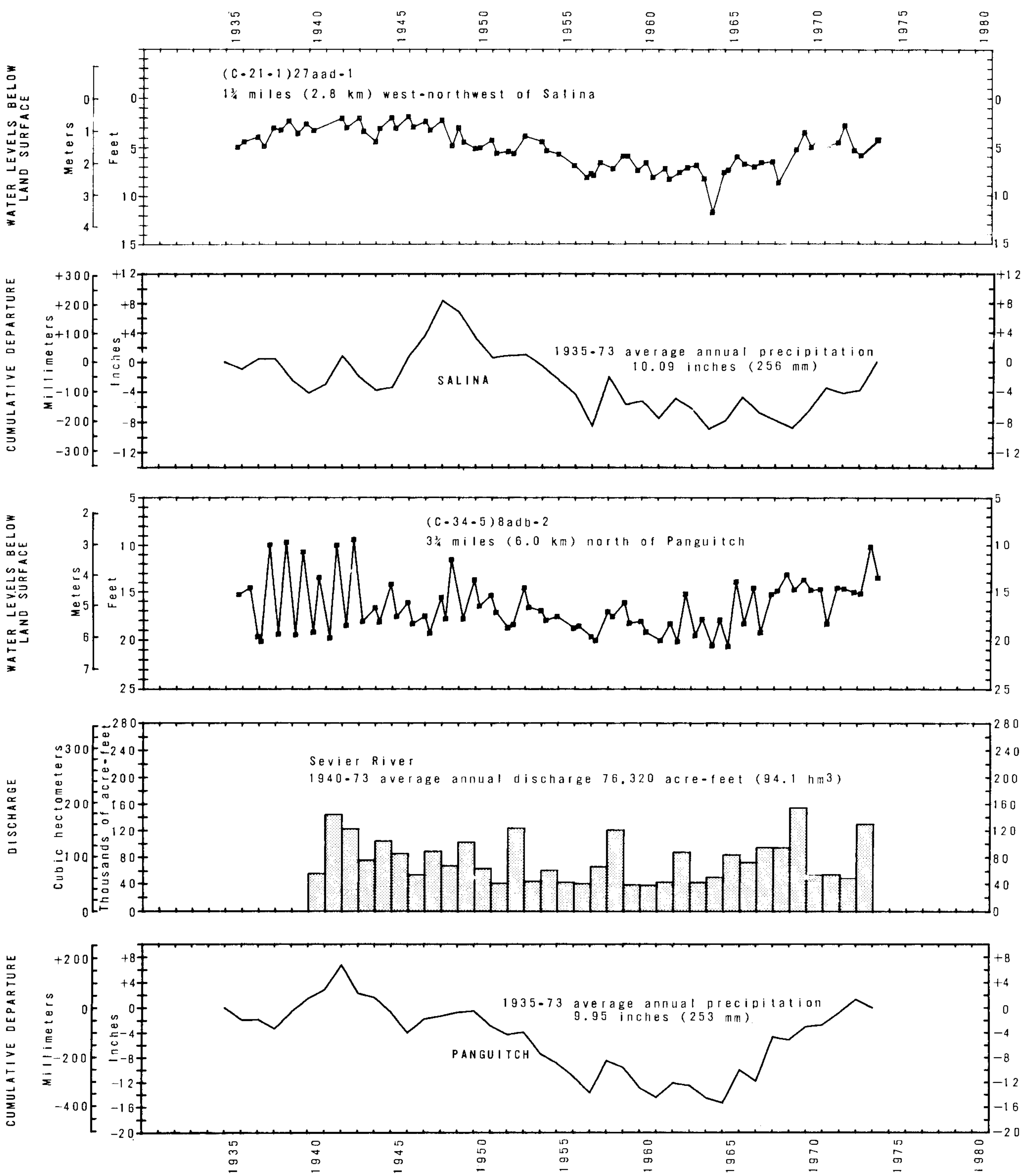

Figure 26.— Relation of water levels in selected wells in the upper and central Sevier Valleys to discharge of the Sevier River at Hatch and to cumulative departure from the average annual precipitation at Salina and Panguitch.

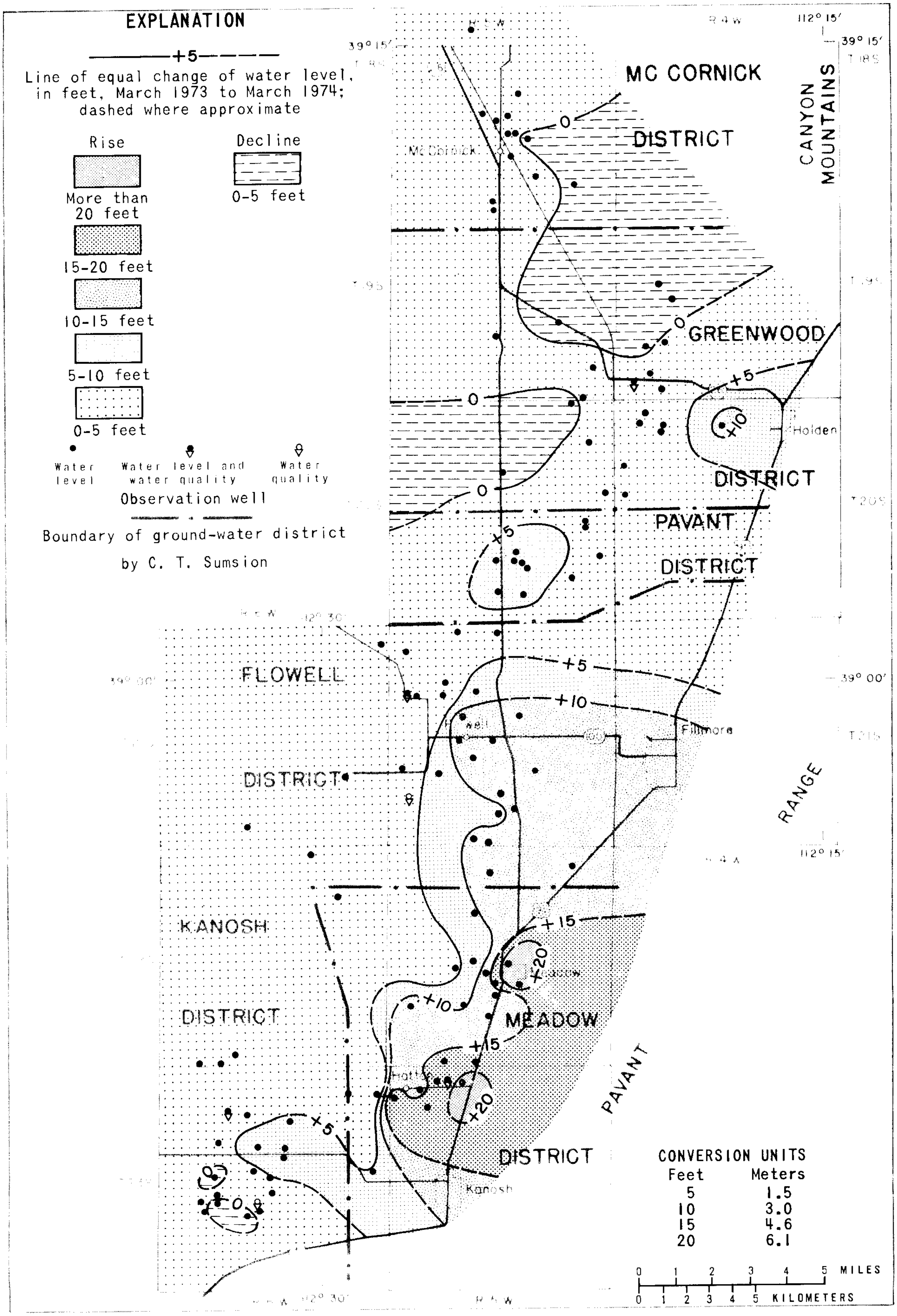

Figure 27.—Map of Pavant Valley showing change of water levels from March 1973 to March 1974.

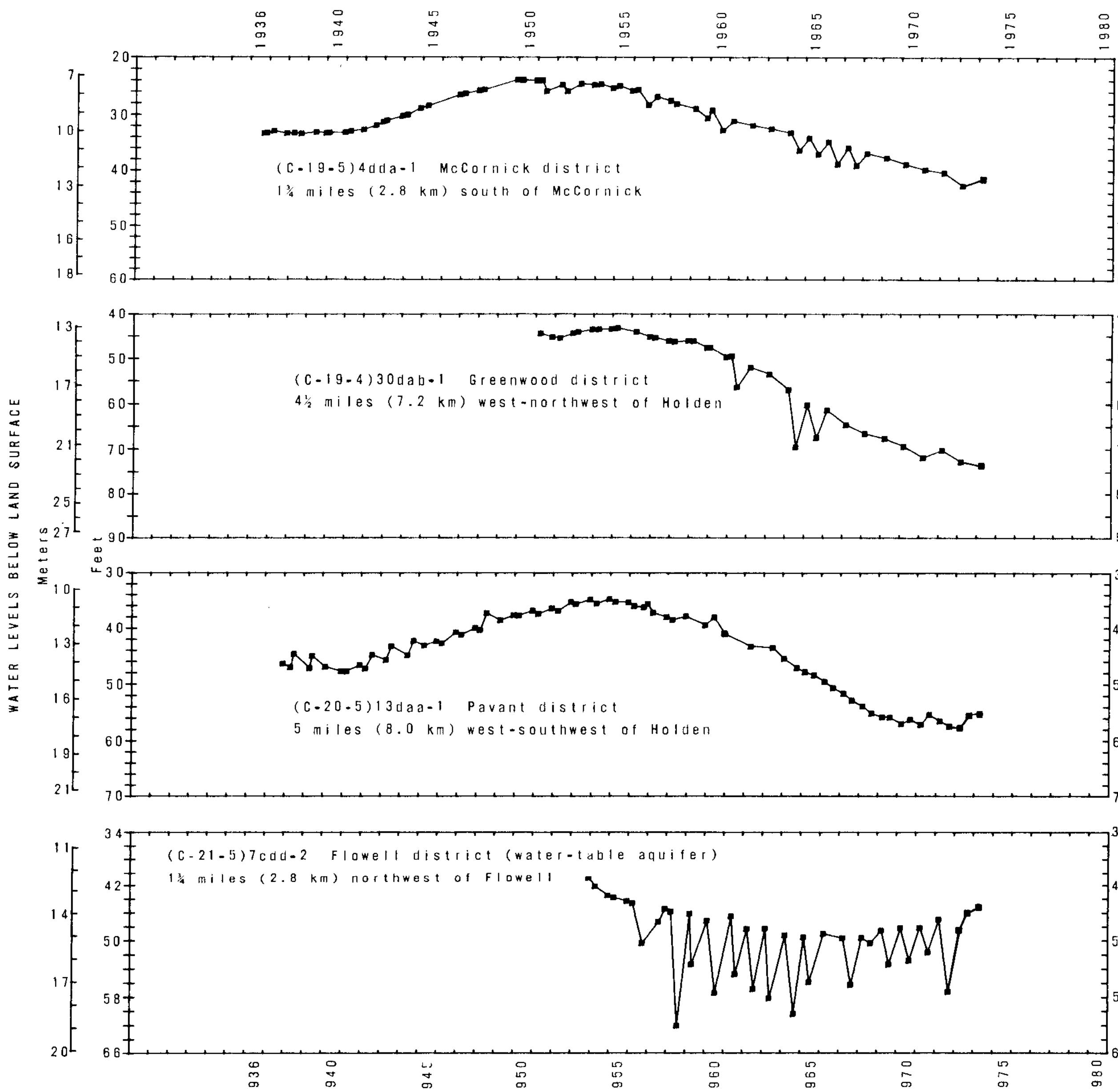

Figure 28.— Relation of water levels in selected wells in Pavant Valley to cumulative departure from the average annual precipitation at Fillmore and to total withdrawals from wells.

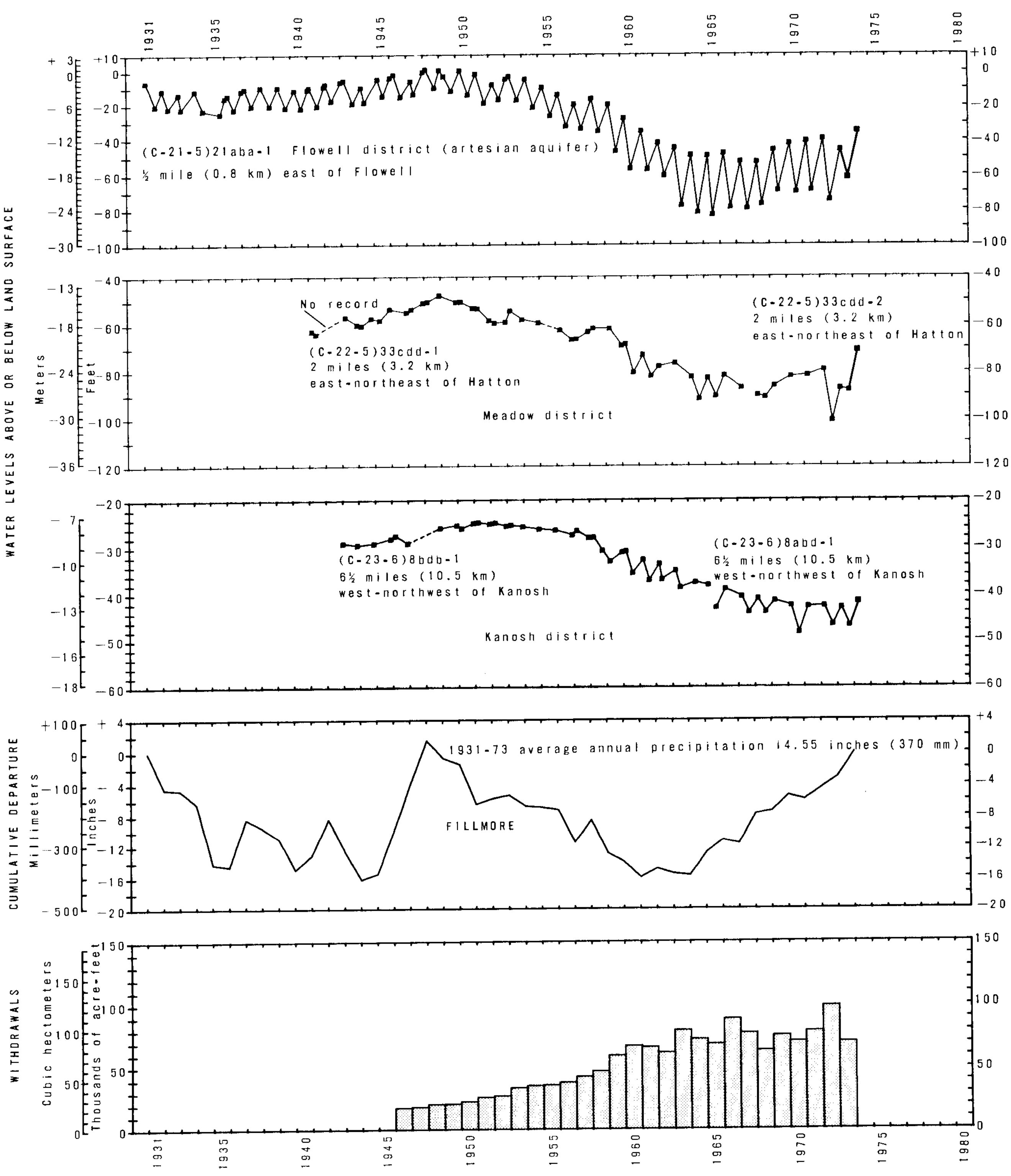

Figure 28.— Continued.

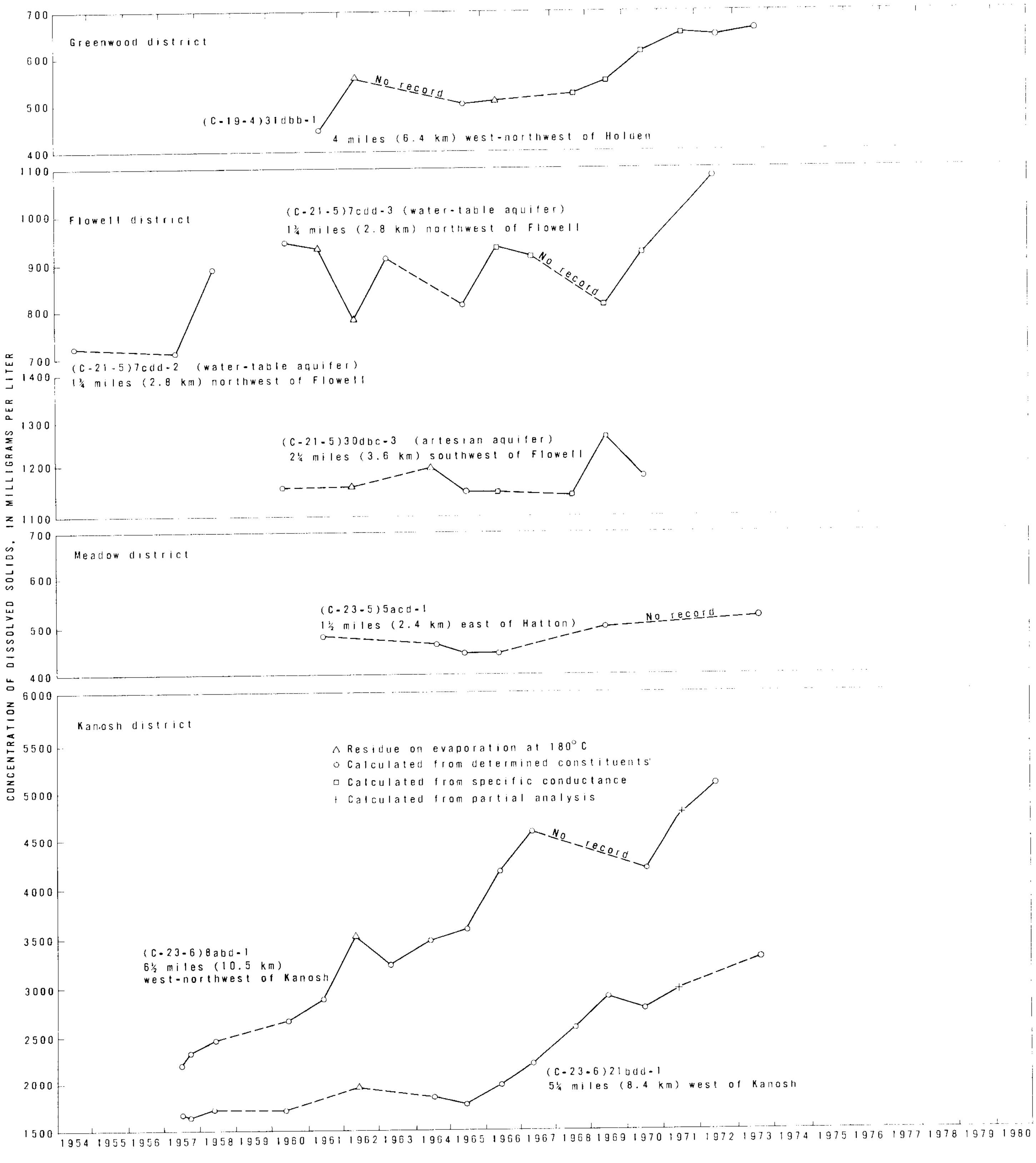

Figure 29.—Concentration of dissolved solids in water from selected wells in Pavant Valley.

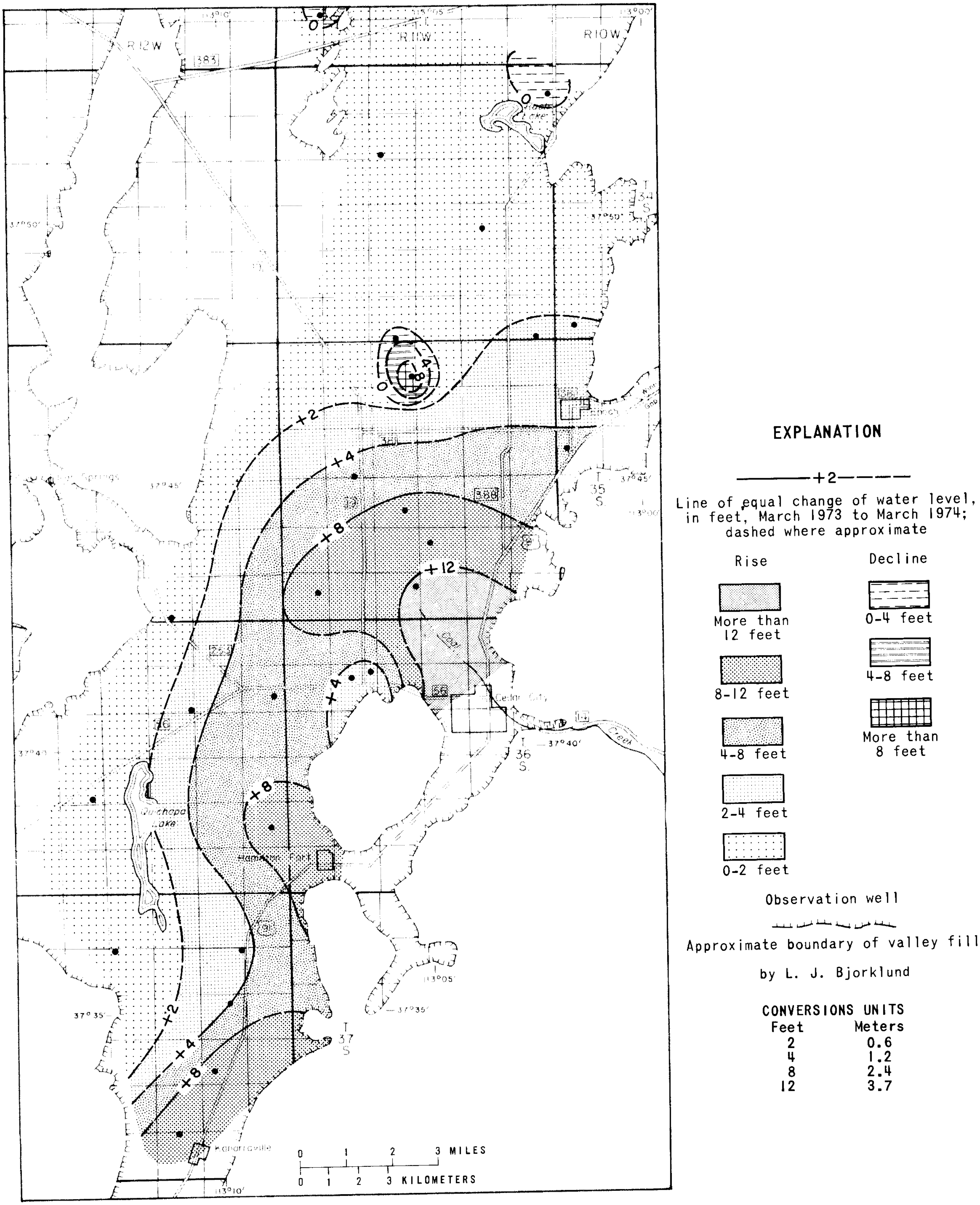

Figure 30.- Map of Cedar City Valley showing change of water levels from March 1973 to March 1974

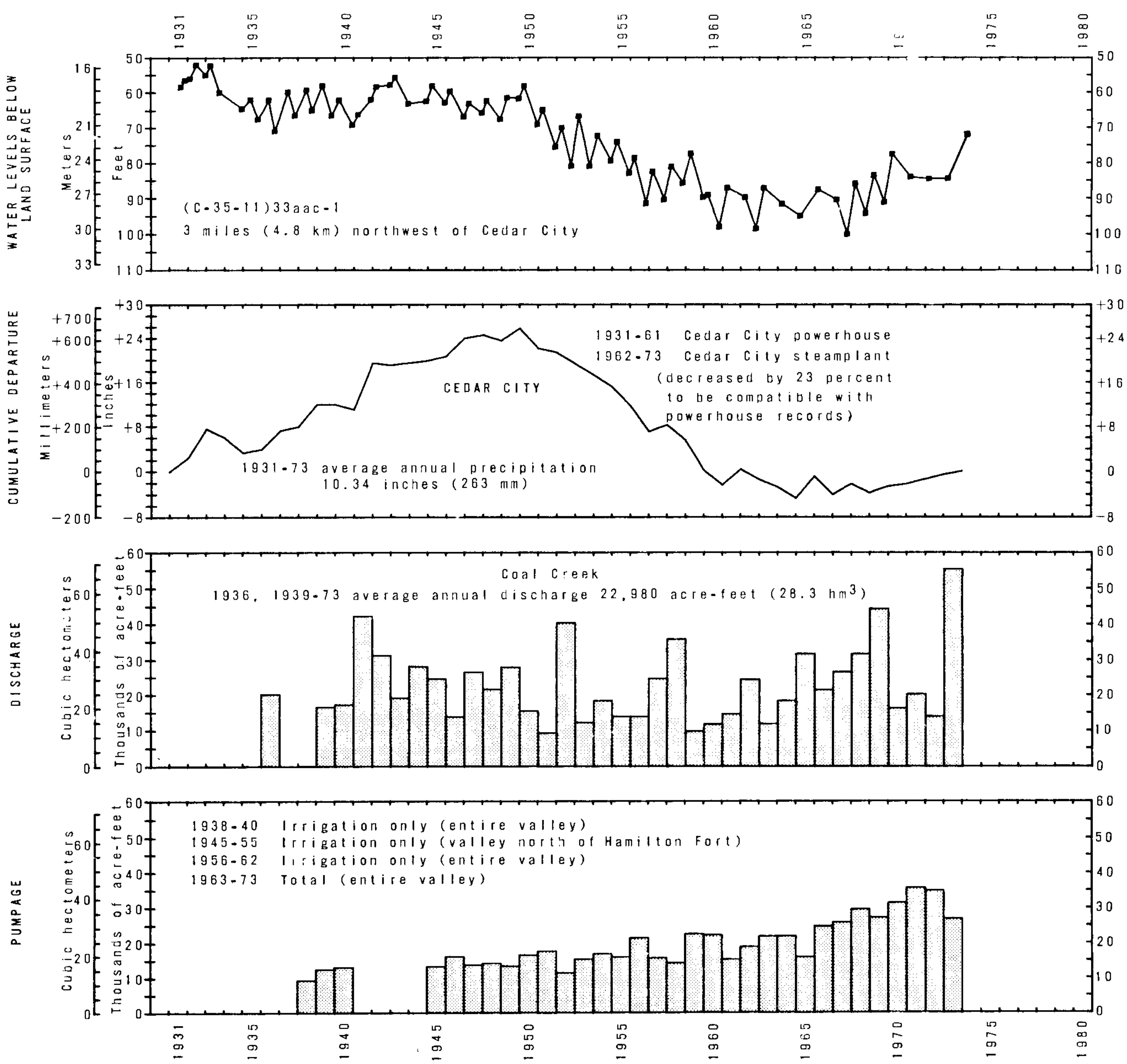

Figure 31.—Relation of water levels in well (C-35-11)33aac-1 in Cedar City Valley to cumulative departure from the average annual precipitation at the Cedar City steamplant, to discharge of Coal Creek near Cedar City, and to pumpage from wells.

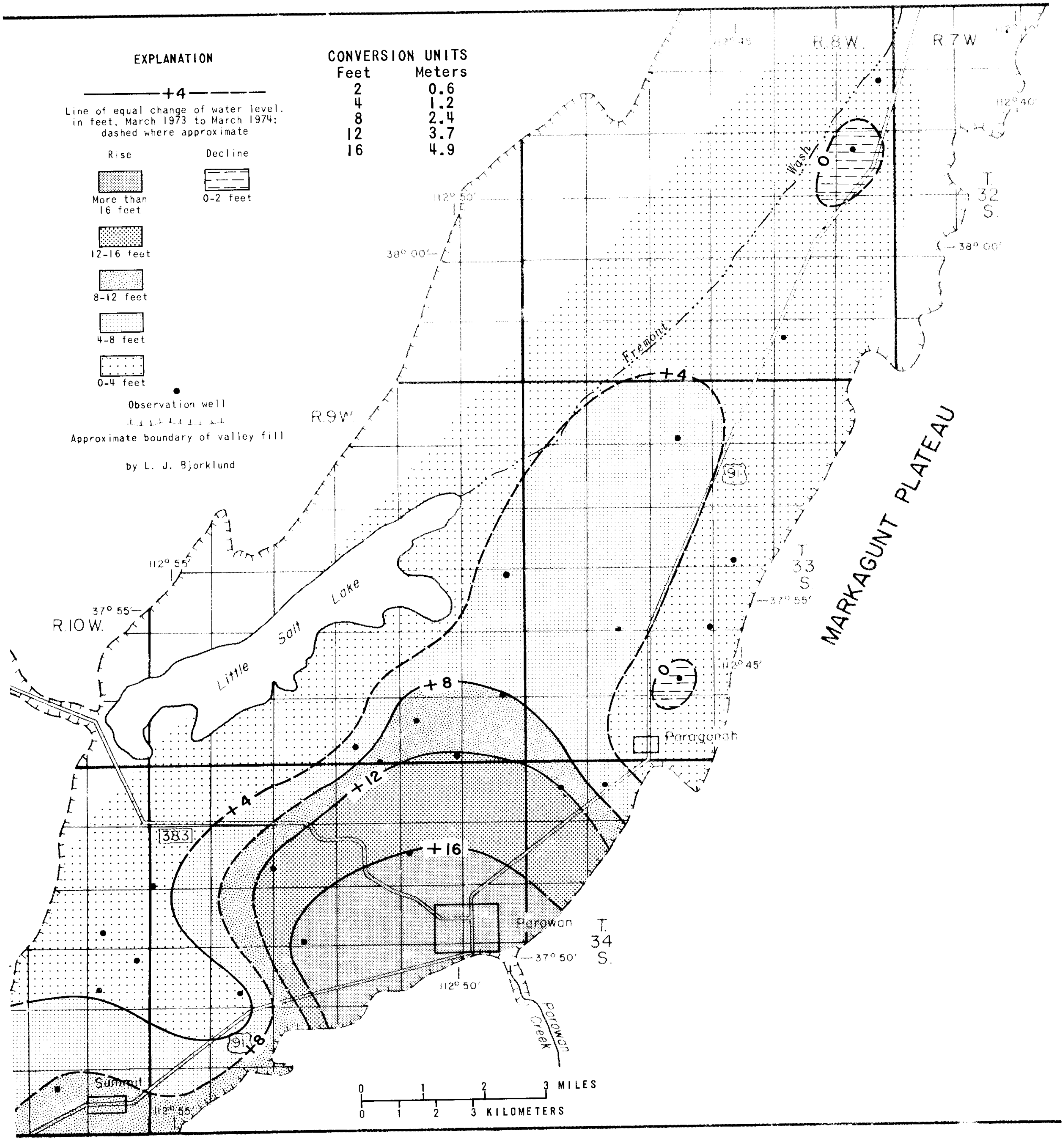

Figure 32.— Map of Parowan Valley showing change of water levels from March 1973 to March 1974.

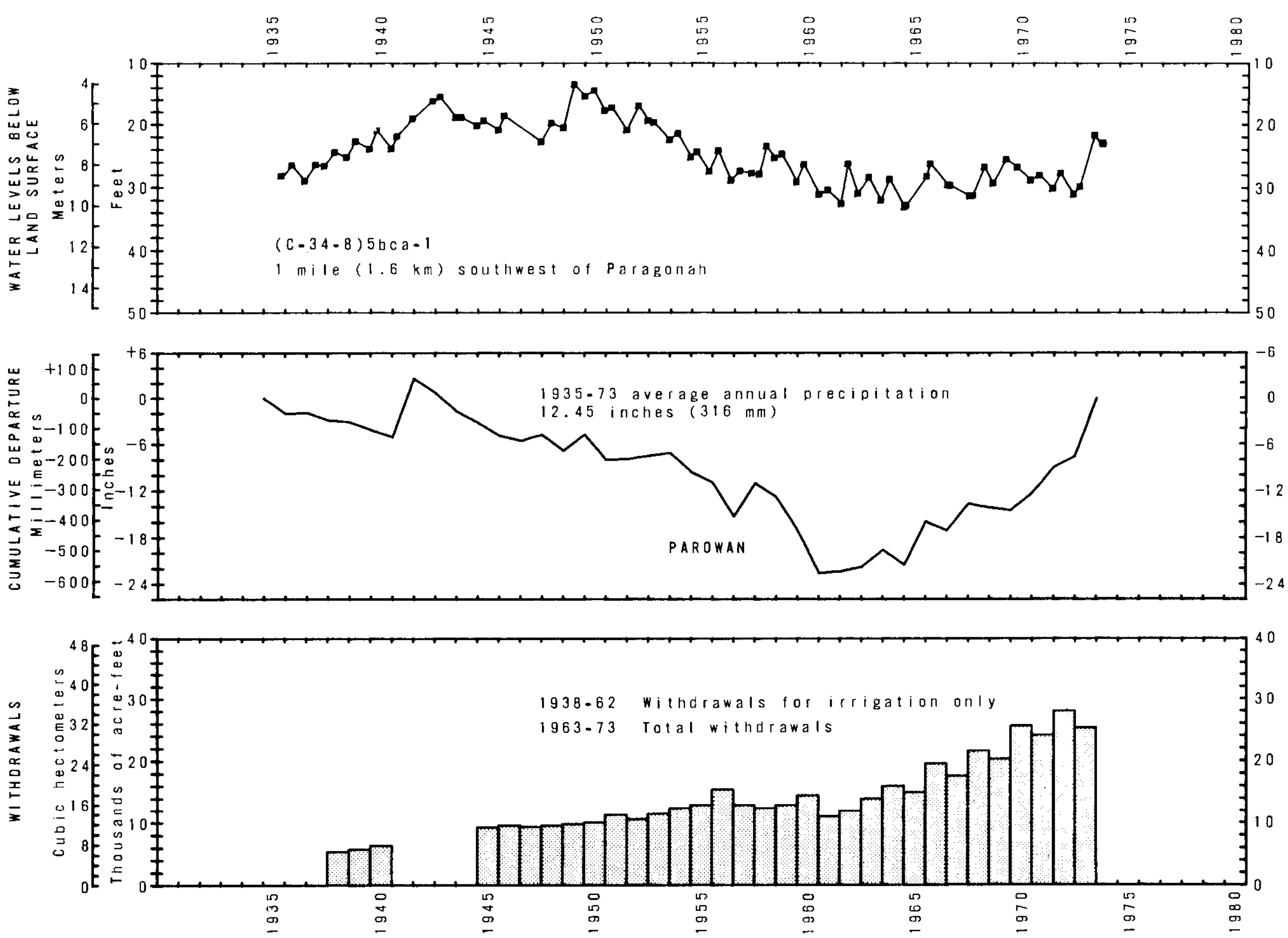

Figure 33.— Relation of water levels in well (C-34-8)5bca-1 in Parowan Valley to cumulative departure from the average annual precipitation at Parowan and to withdrawals from wells.

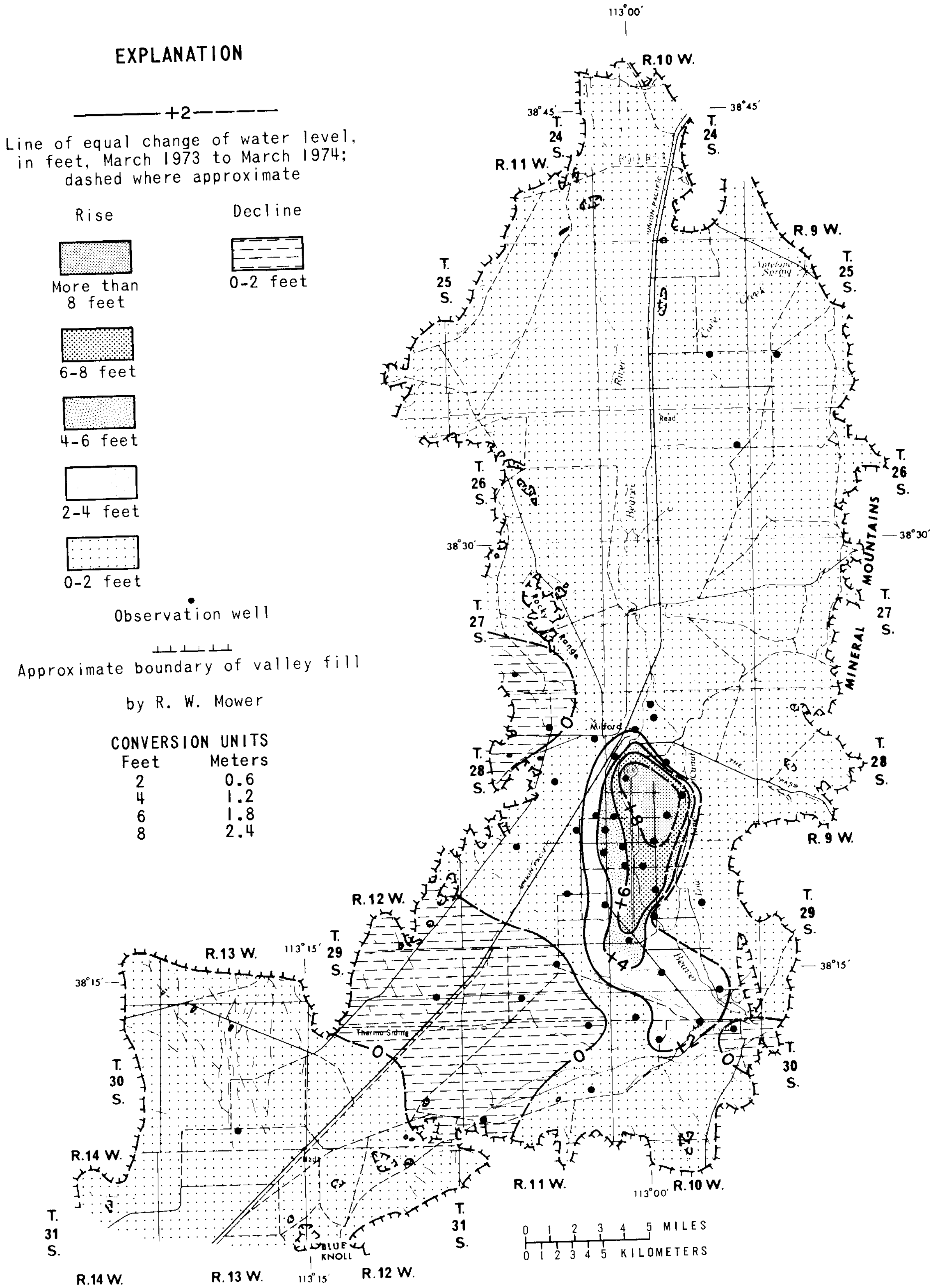

Figure 34.– Map of the Milford area, Escalante Valley, showing change of water levels from March 1973 to March 1974.

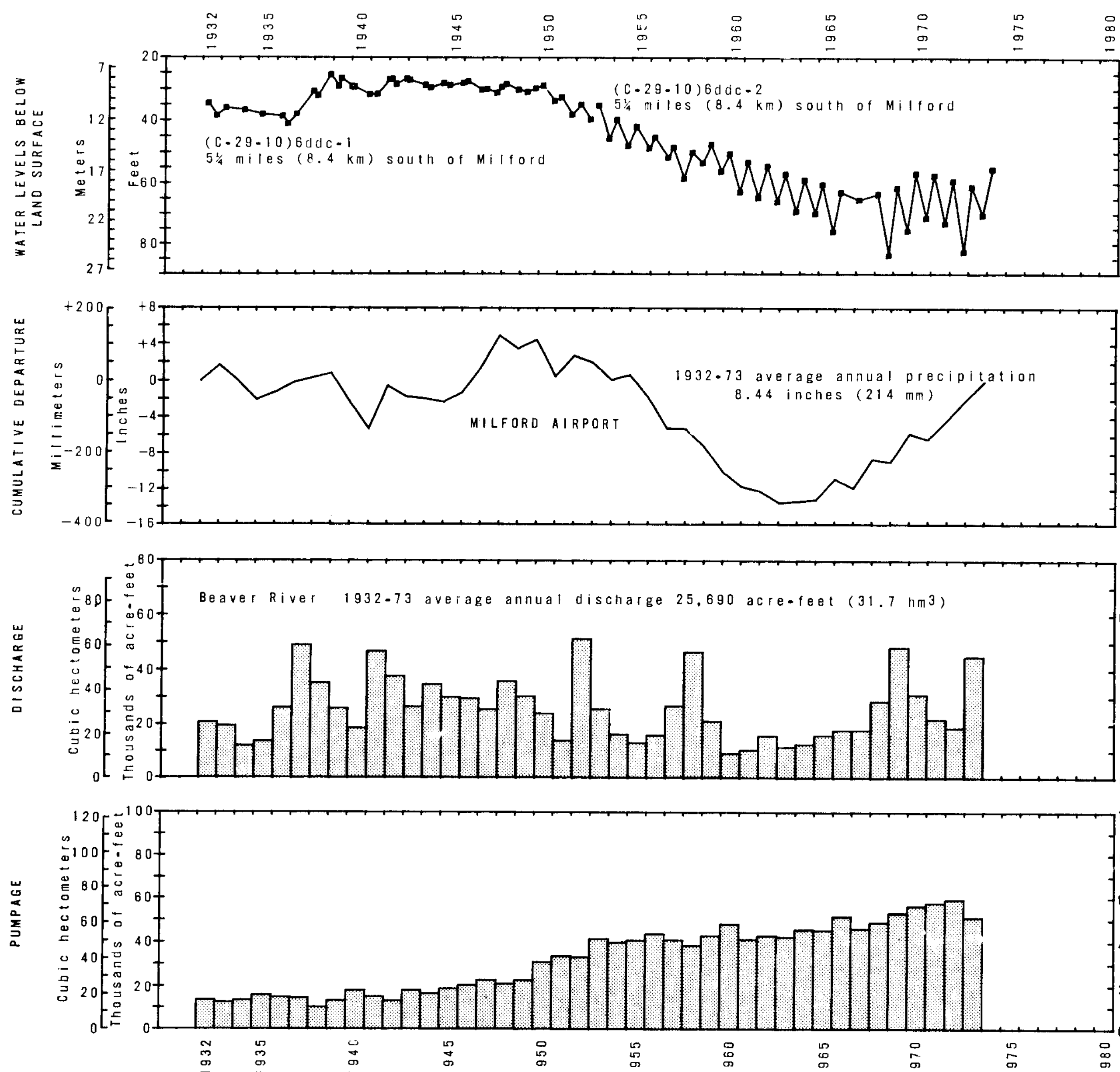

Figure 35.— Relation of water levels in selected wells in the Milford area, Escalante Valley, to cumulative departure from the average annual precipitation at Milford airport, to discharge of the Beaver River at Rockyford Dam near Minersville, and to pumpage for irrigation.

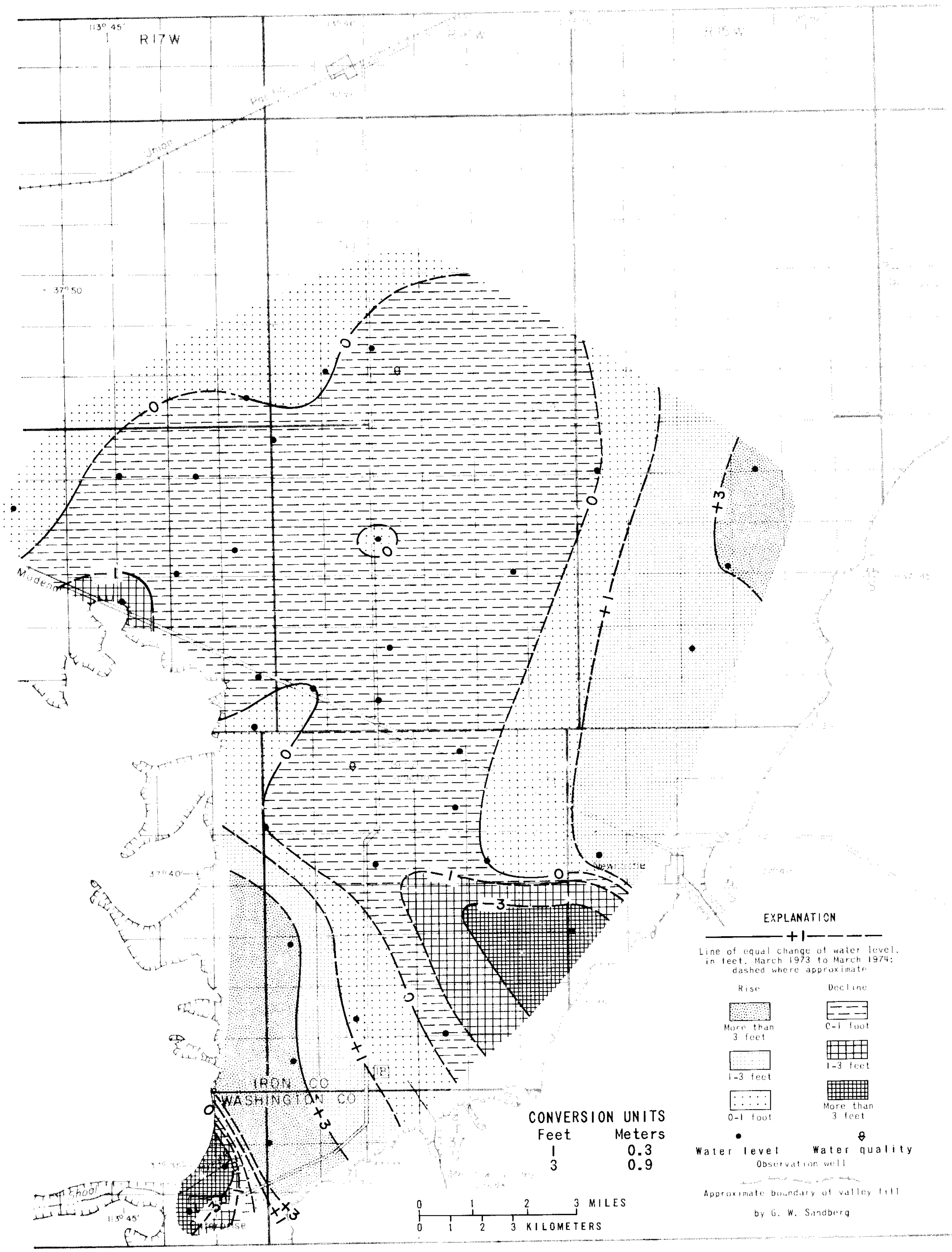

Figure 36.— Map of the Beryl-Enterprise area, Escalante Valley, showing change of water levels from March 1973 to March 1974.

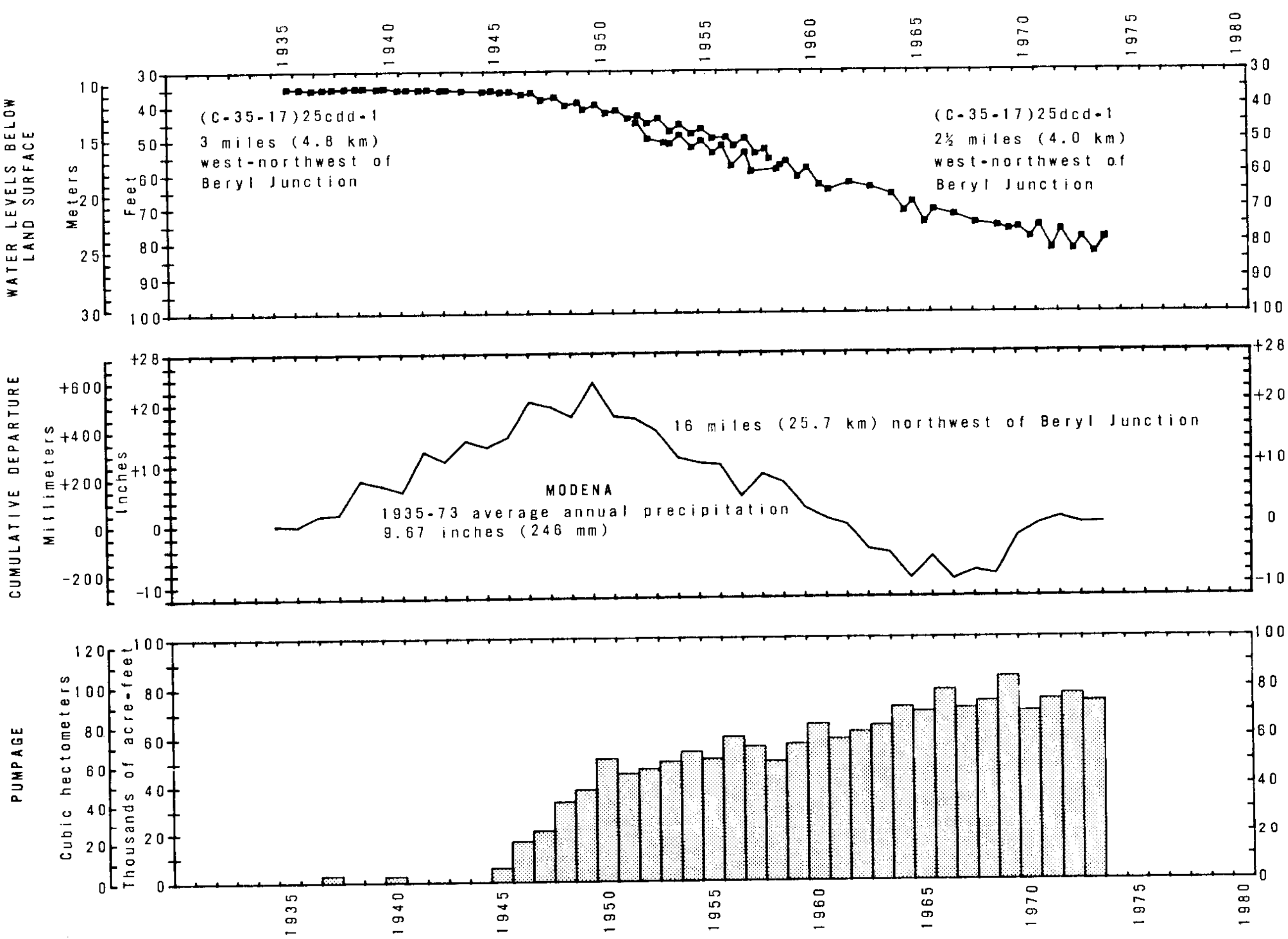

Figure 37.— Relation of water levels in selected wells in the Beryl-Enterprise area, Escalante Valley, to cumulative departure from the average annual precipitation at Modena and to pumpage for irrigation.

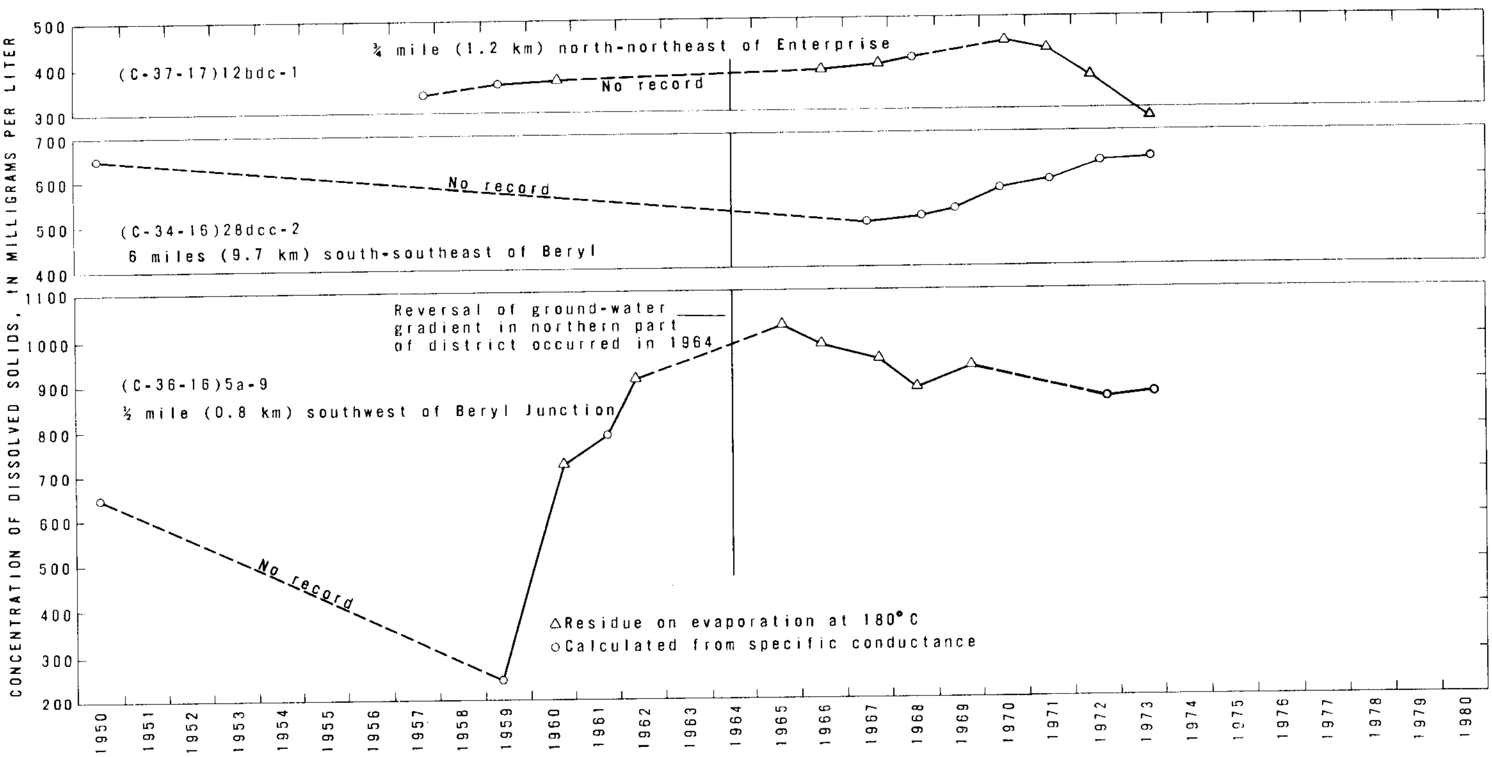

Figure 38.— Concentration of dissolved solids in water from selected wells in the Beryl-Enterprise area, Escalante Valley.

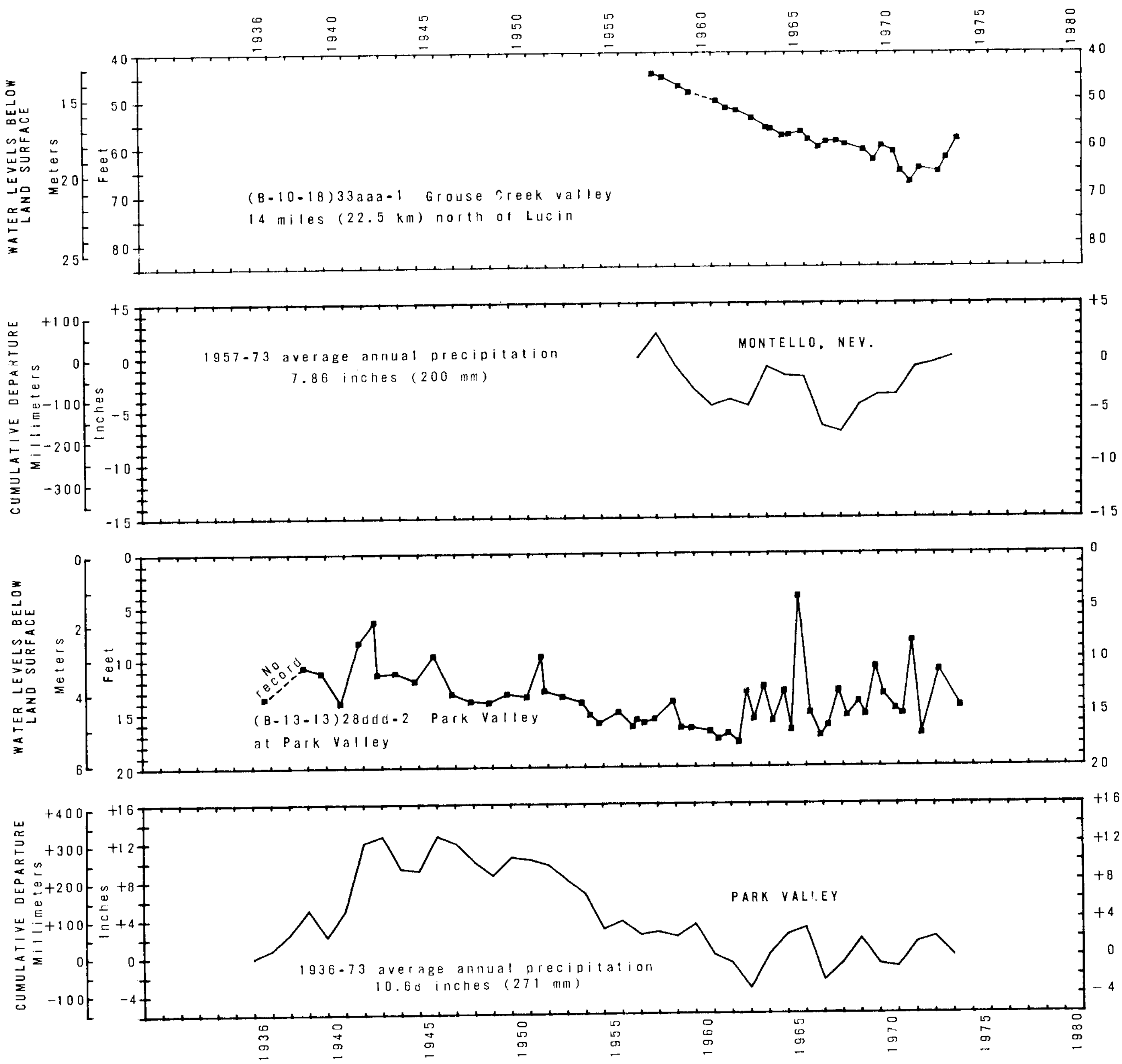

Figure 39.—Relation of water levels in wells in selected areas of Utah to cumulative departure from the average annual precipitation at sites in or near those areas.

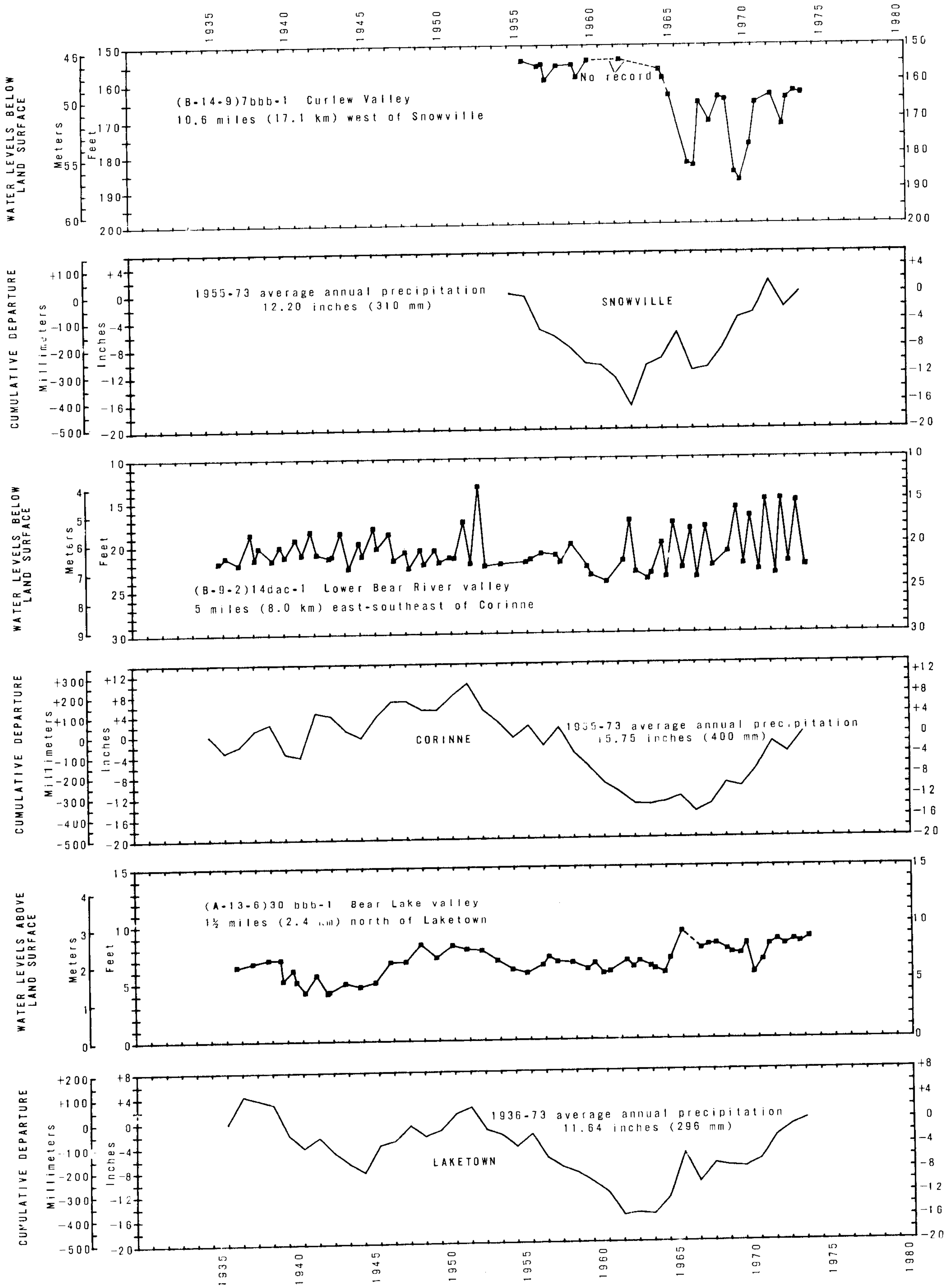

Figure 39.— Continued.

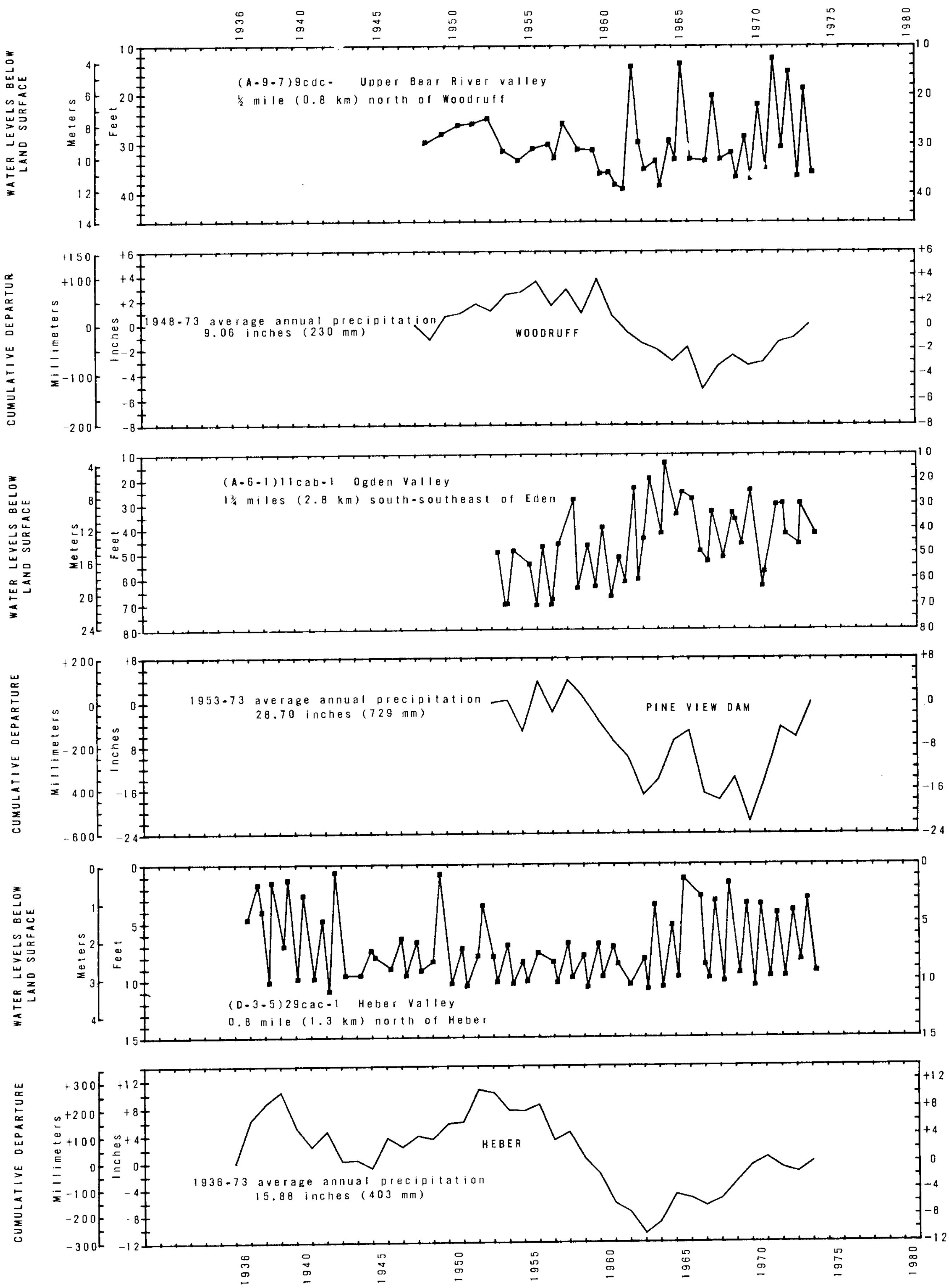

Figure 39.— Continued.

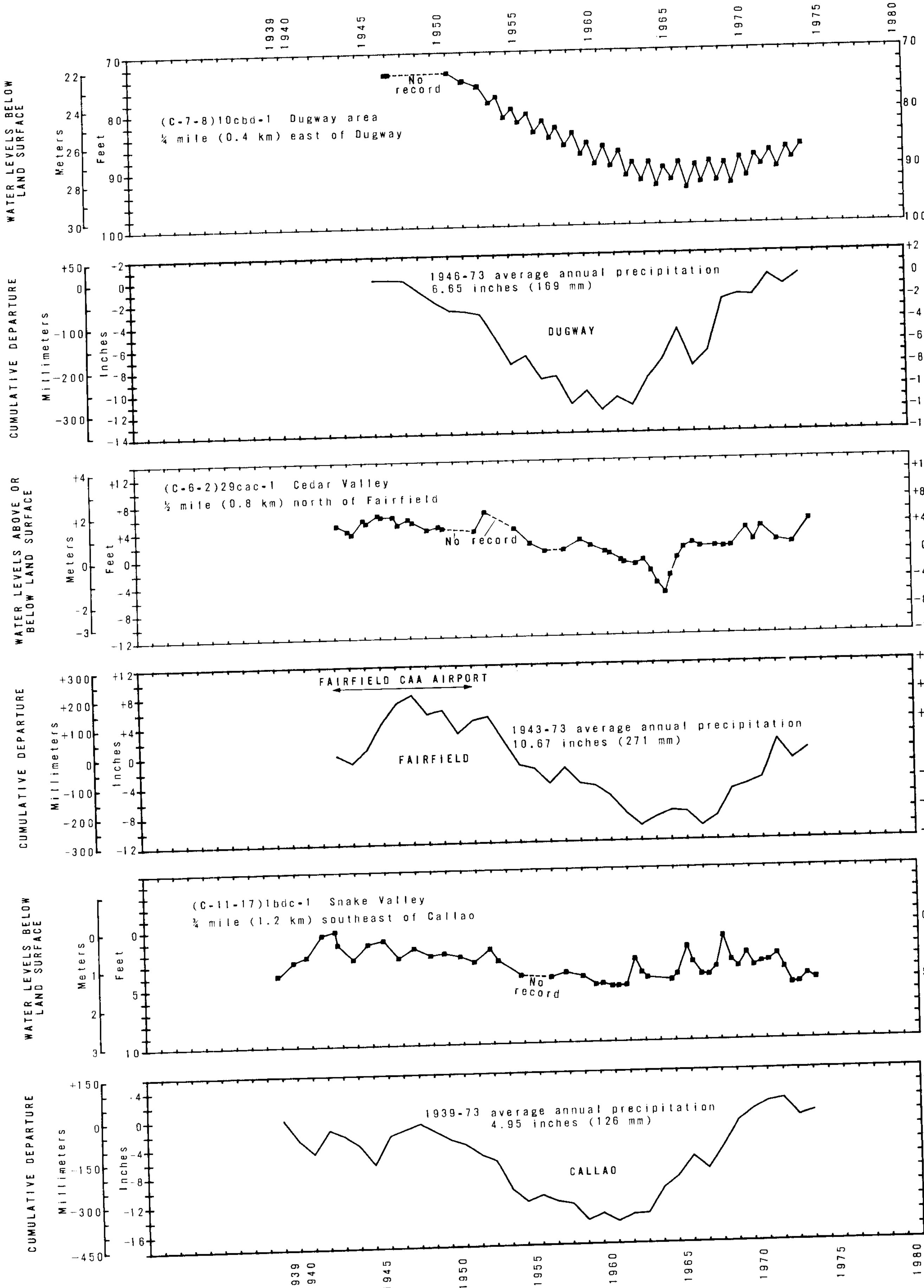

Figure 39.— Continued.

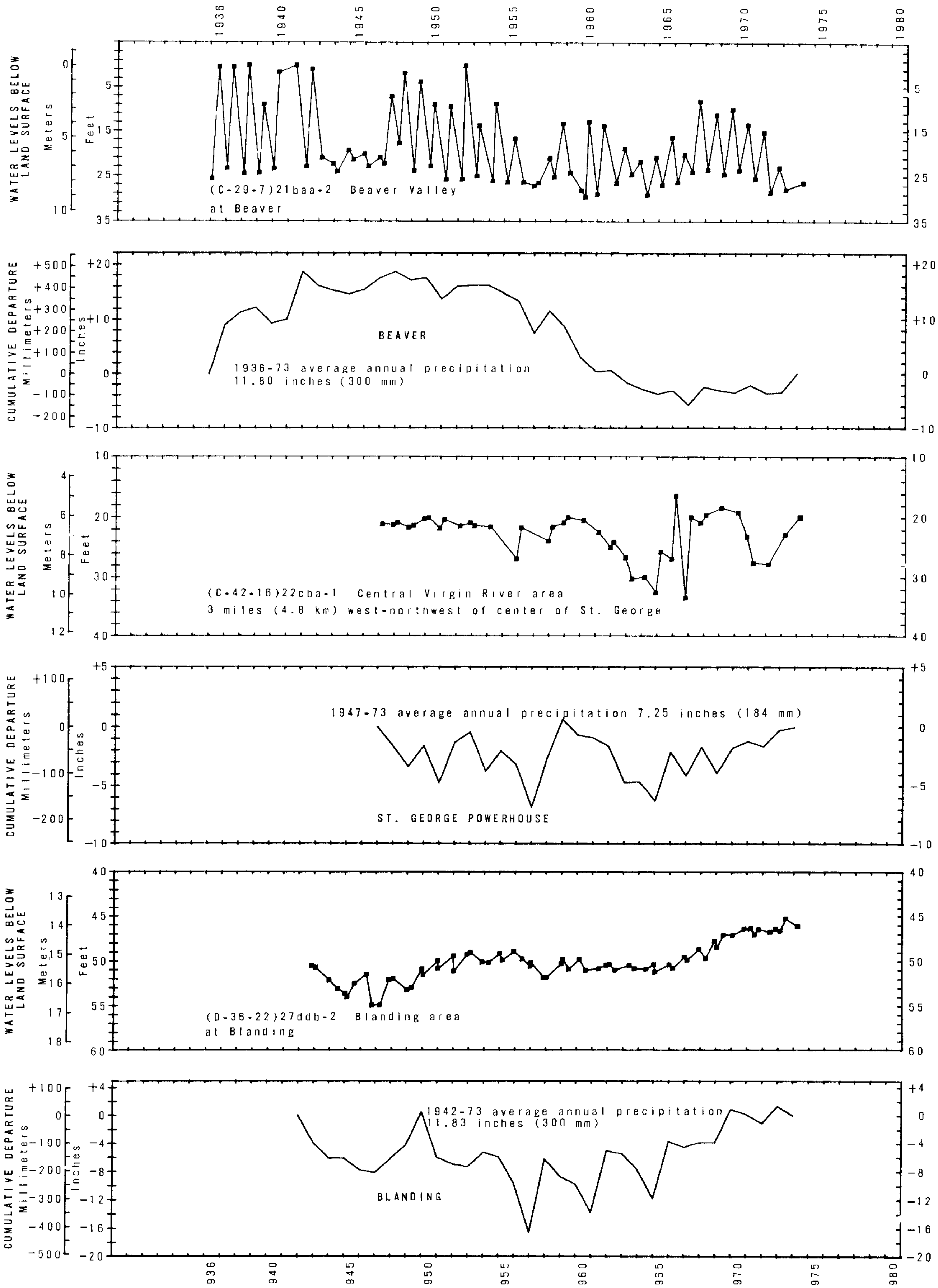

Figure 39.—Continued.

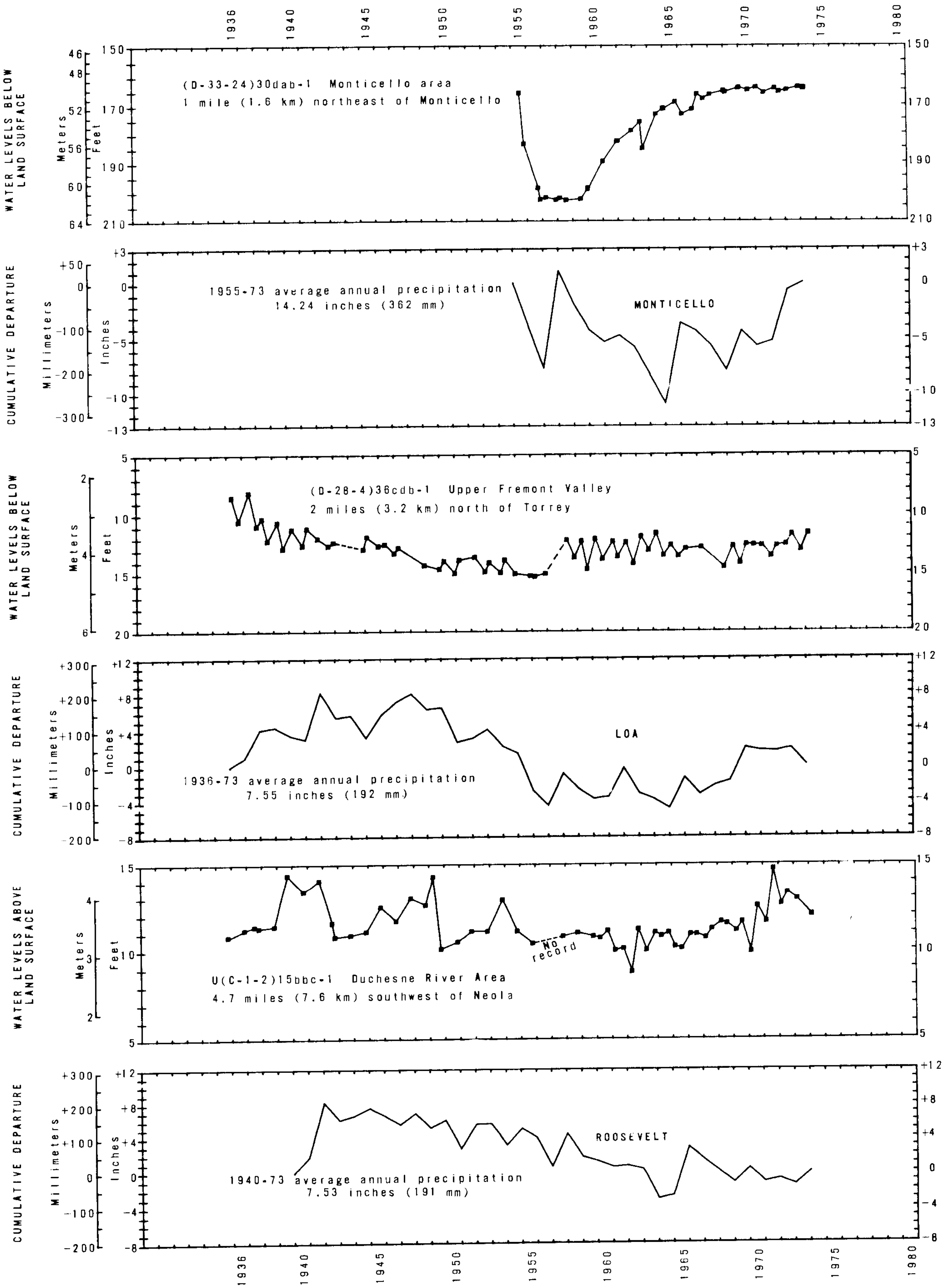

Figure 39.— Continued.

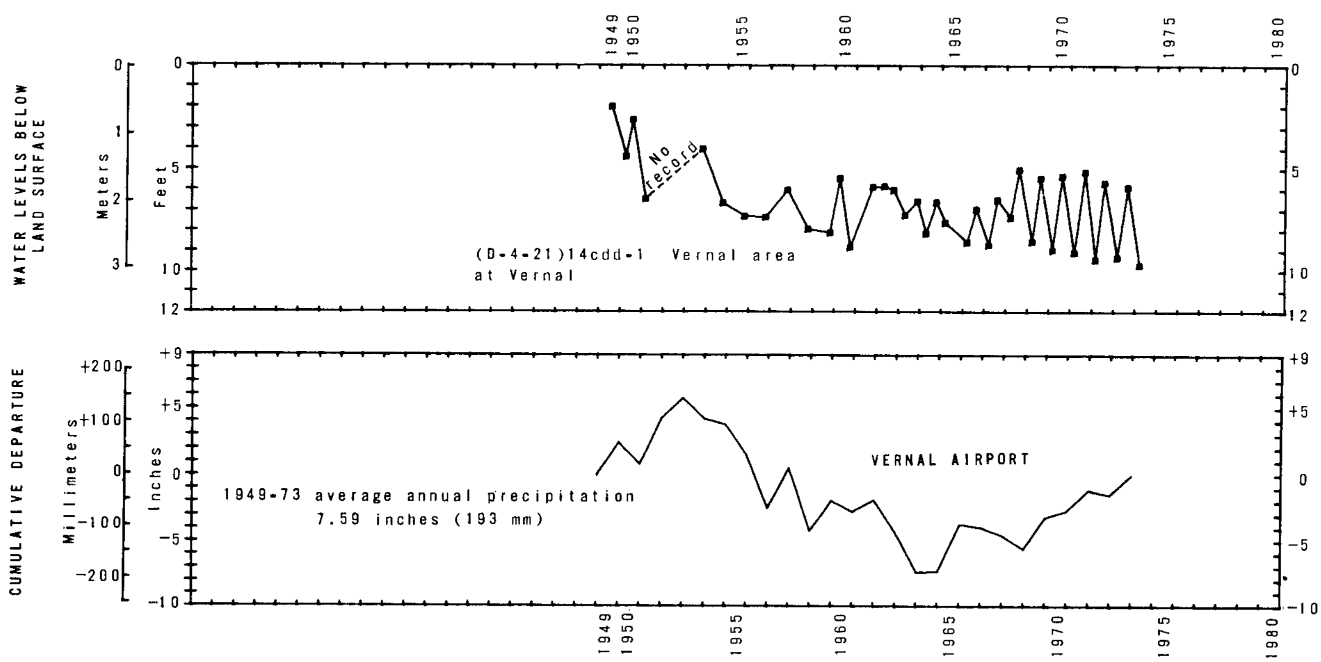

Figure 39.— Continued.